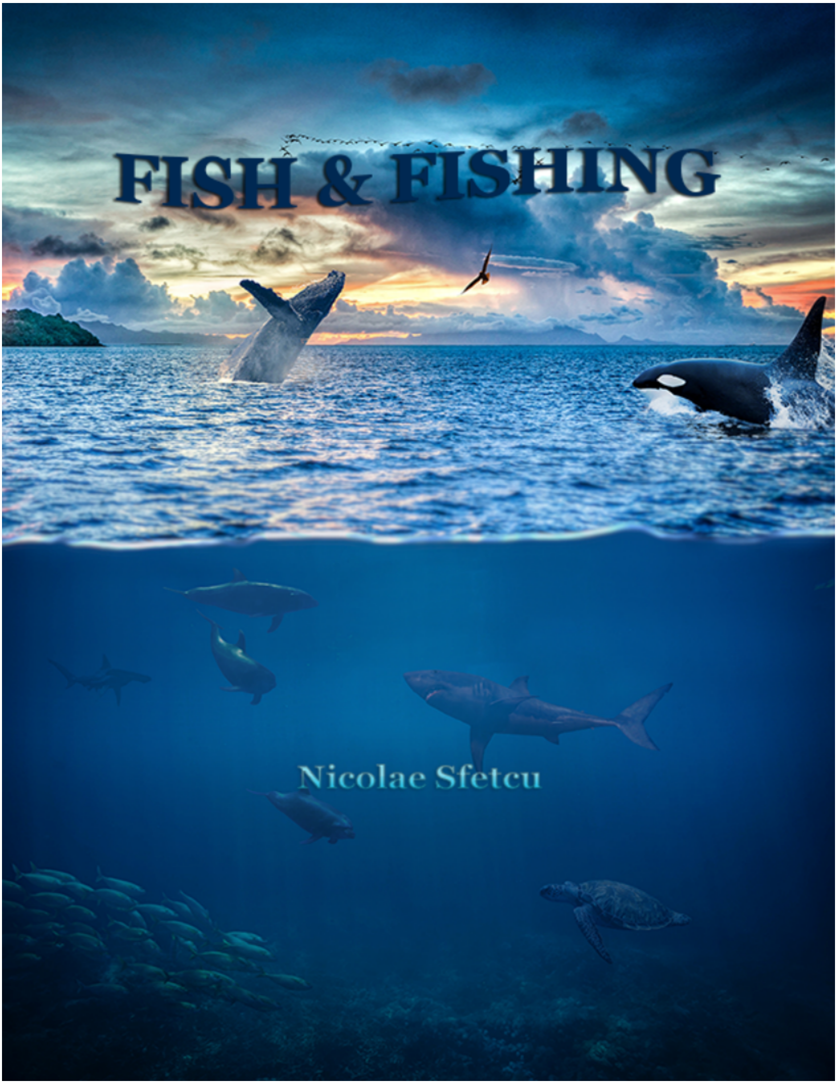
FISH & FISHING

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Fish & Fishing

A **fish** is a water-dwelling vertebrate with gills that doesn't change form, as amphibians do, during its life. Most are cold-blooded, though some (such as some species of tuna and shark) are warm-blooded. There are over 29,000 species of fish, making them the most diverse group of vertebrates. Taxonomically, fish are a paraphyletic group whose exact relationships are much debated; a common division is into the jawless fish (class Agnatha, 75 species including lampreys and hagfish), the cartilaginous fish (class Chondrichthyes, 800 species including sharks and rays), with the remainder classed as bony fish (class Osteichthyes).

Fish come in different sizes, from the 16 m (51 ft) whale shark to a 8 mm (just over ¼ of an inch) long stout infantfish. Many types of aquatic animals named "fish" are not true fish, and in the case of animals such as jellyfish and cuttlefish, are not even vertebrates. Other marine creatures that have in the past been considered fish, like dolphins, are actually mammals.

Although most fish are exclusively aquatic and cold-blooded, there are exceptions to both cases. Fish from a number of different groups have evolved the capacity to live out of the water for extended periods of time. Of these amphibious fish some such as the mudskipper can live and move about on land for up to several days. Also, certain species of fish maintain elevated body temperatures to varying degrees. Endothermic teleosts (bony fishes) are all in the suborder Scombroidei and include the billfishes, tunas, and one species of "primitive" mackerel (*Gasterochisma melampus*). All sharks in the family Lamnidae – shortfin mako, long fin mako, white, porbeagle, and salmon shark – are known to have the capacity for endothermy, and evidence suggests the trait exists in family Alopiidae (thresher sharks). The degree of endothermy varies from the billfish, which warm only their eyes and brain, to bluefin tuna and porbeagle sharks who maintain body temperatures elevated in excess of 20 °C above ambient water temperatures. *See also gigantothermy*. Endothermy, though metabolically costly, is thought to provide advantages such as increased contractile force of muscles, higher rates of central nervous system processing, and higher rates of digestion.

Fish are an important source of food in many cultures. Other water-dwelling animals such as mollusks, crustaceans, and shellfish are often called "fish" when used as food. For more details, see Fish food.

Fish

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Classification

Fish are a paraphyletic group: that is, any clade containing all fish also contains the tetrapods, which are not fish. For this reason, groups such as the "Class Pisces" seen in older reference works are no longer used in formal classifications.

Fish are classified into the following major groups:

- Hyperoartia
    - Petromyzontidae (lampreys)
- Pteraspidomorphi (early jawless fish)
- Thelodonti
- Anaspida
- Cephalaspidomorphi (early jawless fish)
    - Galeaspida
    - Pituriaspida
    - Osteostraci
- Gnathostomata (jawed vertebrates)
    - Placodermi
    - Chondrichthyes (cartilaginous fish)
    - Acanthodii
    - Osteichthyes (bony fish)
        - Actinopterygii (ray-finned fish)
        - Sarcopterygii (lobe-finned fish)
            - Actinistia (coelacanths)
            - Dipnoi (lungfish)

Some palaeontologists consider that Conodonta are chordates, and so regard them as primitive fish.

For a fuller treatment of classification, see the vertebrate article.

Fish anatomy

Main article: Fish anatomy

Digestive system

The advent of jaws allowed fish eat a much wider variety of food, including plants and other organisms. In fish, food is ingested through the mouth and then broken down in the esophagus. When it enters the stomach, the food is further broken down and, in many fish, further processed in fingerlike pouches called pyloric ceca. The pyloric ceca secrete digestive enzymes and absorb nutrients from the digested food. Organs such as the liver and pancreas add enzymes and various digestive chemicals as the food moves through the digestive tract. The intestine completes the process of digestion and nutrient absorption.

Respiratory system

Most fish exchange gases by using gills that are located on either side of the pharynx. Gills are made up of threadlike structures called filaments. Each filament contains a network of capillaries that allow a large surface area for the exchange of oxygen and carbon dioxide. Fish exchange gases by pulling oxygen-rich water through their mouths and pumping it over their gill filaments. The blood in the capillaries flows in the opposite direction to the water, causing counter current exchange. They then push the oxygen-poor water out through openings in the sides of the pharynx. Some fishes, like sharks and lampreys, possess multiple gill openings. However, most fishes have a single gill opening on each side of the body. This opening is hidden beneath a protective bony cover called an operculum. Some fishes, such as lungfish, have developed an adaptation known as a labyrinth that allows them to survive in oxygen-poor areas or places where bodies of water constantly dry up. These species of fish possess specialized organs that serve as lungs. A tube brings air containing oxygen to this organ by way of the fish's mouth. Some kinds of lungfish are so dependent on receiving oxygen from the air that they will suffocate if not allowed to reach the surface of the water.

Circulatory system

Fish have a closed circulatory system with a heart that pumps the blood in a single loop throughout the body. The blood goes from the heart to gills, from the gills to the rest of the body, and then back to the heart. In most fishes, the heart consists of four parts: the sinus venosus, the atrium, the ventricle, and the bulbus arteriosus. Despite consisting of four parts, the fish heart is still a two-chambered heart. The sinus venosus is a thin-walled sac that collects blood from the fish's veins before allowing it to flow to the atrium, which is a large muscular chamber. The atrium serves as a one-way compartment for blood to flow into the ventricle. The ventricle is a thick-walled, muscular chamber and it does the actual pumping for the heart. It pumps blood to a large tube called the bulbus arteriosus. At the front end, the bulbus arteriosus connects to a large blood vessel called the aorta, through which blood flows to the fish's gills.

Excretory system

As with many aquatic animals, most fishes release their nitrogenous wastes as ammonia. Some of the wastes diffuse through the gills into the surrounding water. Others are removed by the kidneys, excretory organs that filter wastes from the blood. Kidneys help fishes control the amount of ammonia in their bodies. Saltwater fish tend to lose water because of osmosis. In saltwater fish, the kidneys concentrate wastes and return as much water as possible back to the body. The reverse happens in freshwater fish, they tend to gain water continuously. The kidneys of freshwater fish are specially adapted to pump out large amounts of dilute urine. Some fish have specially adapted kidneys that change their function, allowing them to move from freshwater to saltwater.

Sensory and nervous system

Fish have well-developed nervous systems that organize around a central brain, that is divided into different parts. The most anterior, or front, end of the brain are the olfactory bulbs, which are involved in the fish's sense of smell. Unlike most vertebrates, the cerebrum of the fish primarily processes the sense of smell rather than being responsible for all voluntary actions. The optic lobes process information from the eyes. The cerebellum coordinates body movements while the medulla oblongata controls the functions of internal organs. Most fishes possess highly developed sense organs. Nearly all daylight fish have well-developed eyes that have color vision that is at least good as a human's. Many fish also have specialized cells known as chemoreceptors that are responsible for extraordinary senses of taste and smell. Although they have ears in their heads, many fish may not hear sounds very well. However, most fishes have sensitive receptors that form the lateral line system. The lateral line system allows for many fish to detect gentle currents and vibrations, as well as to sense the motion of other nearby fish and prey. In 2003, it was also found by Scottish scientists at Edinburgh University performing research on rainbow trout that fish experience pain. Some fishes, such as catfish and sharks, have organs that detect low levels electric current. Other fishes, like the electric eel, can produce their own electricity.

Muscular system

Fish locomotion

Most fish move by contracting paired sets of muscles on either side of the backbone alternately. These contractions form S-shaped curves that move down the body of the fish. As each curve reaches the back fin, backward force is created. This backward force, in conjunction with the fins, moves the fish forward. The fish's fins are used like an airplane's stabilizers. Fins also increase the surface area of the tail, allowing for an extra boost in speed. The streamlined body of the fish decreases the amount of friction as they move through water. Since body tissue is more dense than water, fish must compensate for the difference or they will sink. Many bony fishes have an internal organ called a swim bladder that adjust their buoyancy through manipulation of gases.

Reproductive system

The eggs of fish are fertilized either externally or internally, depending on species. The female usually lays the eggs, and the embryos in the eggs develop and hatch outside her body. These kind of fish are called oviparous fish. Oviparous fish develop by obtaining food from the yolk in the egg. Salmon, for example, are oviparous.

Ovoviviparous fish keep the eggs inside of the mother's body after internal fertilization. Each embryo develops in its own egg. The young are "born alive" like most mammals.

Some species of fish, such as various sharks, are viviparous. Viviparous fish allow their embryos to stay in the mother's body like ovoviviparous fish. However, the embryos of viviparous fish obtain needed substances from the mother's body, not through material in the egg. The young of viviparous species are also "born alive".

Immune system

Types of immune organs vary between different types of fish.[1] In the jawless fish (lampreys and hagfishes), true lymphoid organs are absent. Instead, these fish rely on regions of lymphoid tissue within other organs to produce their immune cells. For example, erythrocytes, macrophages and plasma cells are produced in the anterior kidney (or pronephros) and some areas of the gut (where granulocytes mature) resemble primitive bone marrow in hagfish. Cartilaginous fish (sharks and rays) have a more advanced immune system than the jawless fish. They have three specialized organs that are unique to chondrichthyes; the epigonal organs (lymphoid tissue similar to bone marrow of mammals) that surround the gonads, the Leydig’s organ within the walls of their esophagus, and a spiral valve in their intestine. All these organs house typical immune cells (granulocytes, lymphocytes and plasma cells). They also possess an identifiable thymus and a well-developed spleen (their most important immune organ) where various lymphocytes, plasma cells and macrophages develop and are stored. Chondrostean fish (sturgeons, paddlefish and birchirs) possess a major site for the production of granulocytes within a mass that is associated with the meninges (membranes surrounding the central nervous system) and their heart is frequently covered with tissue that contains lymphocytes, reticular cells and a small number of macrophages. The chondrostean kidney is an important hemopoietic organ; where erythrocytes, granulocytes, lymphocytes and macrophages develop. Like chondrostean fish, the major immune tissues of bony fish (or teleostei) include the kidney (especially the anterior kidney), where many different immune cells are housed[2]. In addition, teleost fish possess a thymus, spleen and scattered immune areas within mucosal tissues (e.g. in the skin, gills, gut and gonads). Much like the mammalian immune system, teleost erythrocytes, neutrophils and granulocytes are believed to reside in the spleen whereas lymphocytes are the major cell type found in the thymus[3][4]. Recently, a lymphatic system similar to that described in mammals was described in one species of teleost fish, the zebrafish. Although not confirmed as yet, this system presumably will be where naive (unstimulated) T cells will accumulate while waiting to encounter an antigen. [5]

Evolution

The early fossil record on fish is not very clear. It appears it was not a successful enough animal early in its evolution to leave many fossils. However, this would eventually change over time as it became a dominant form of sea life and eventually branching to include land vertebrates such as amphibians, reptiles, and mammals.

The formation of the hinged jaw appears to be what resulted in the later proliferation of fish because un-jawed fish left very few ancestors. Lampreys may be a rough representative of pre-jawed fish. The first jaws are found in Placodermi fossils. It is unclear if the advantage of a hinged jaw is greater biting force, respiratory-related, or a combination.

Some speculate that fish may have evolved from a creature similar to a coral-like Sea squirt, whose larvae resemble primitive fish in some key ways. The first ancestors of fish may have kept the larval form into adulthood (as some sea squirts do today, see Neoteny), although the reversal of this case is also possible. Candidates for early fish include Agnatha such as Haikouichthys, Myllokunmingia, and Pikaia.

Fish disease

Main article: Fish diseases

Fish are susceptible to disease as any other organism. Fish diseases can be refered to as etiology:

- Bacterial Disorders
- Fungal Disorders
- Parasitic Disorders
- Viral Disorders
- Metabolic Disorders
- Water conditions
- Malnutrition

or the organ system most affected

- Neurological Disorders
- Body Cavity
- Eye Disorders
- Fecal Disorders
- Fin Disorders
- Gallbladder
- Gill Disorders
- Intestinal Disorders
- Kidney Disorders
- Liver Disorders
- Locomotor Disorders
- Skin Disorders & Changes In Color
- Swim Bladder

See also

- The Wikipedia Fish Category page which provides links to all aspects of the subject from icthyology to aquariums to sharks.
- Fish diseases Fish disease category
- Ichthyology (the study of fish)
- List of fish families
- List of fish common names
- Fish anatomy
- List of freshwater aquarium fish species
- Marine aquarium fish species
- Antimycin A piscicide
- Deep sea fish
- Walking fish

Note on usage: "fish" vs. "fishes"

"Fishes" is the proper English plural form of "fish" that biologists use when speaking about two or more fish species, as in "There are over 25,000 fishes in the world" (meaning that there are over 25,000 fish species in the world). When speaking of two or more individual fish organisms, then the word "fish" is used, as in "There are several million fish of the species Gadus morhua" (meaning that G. morhua comprises several million individuals). To see both in action, consider the statement "There are twelve fish in this aquarium, representing five fishes" (meaning that the aquarium contains twelve individuals, some of the same species and some of different species, for a total of five species). The usage of the two words is similar to that of the words "people" and "peoples". The collective noun for fish is shoal (or *school*).

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Home

Ichthyology

Ichthyology is the branch of zoology devoted to the study of fish. This includes skeletal fish (Osteichthyes), cartilaginous fish (Chondrichthyes), and jawless fish (Agnatha). An estimated 25,000 fish species exist, comprising a majority of vertebrates. While a majority of species have probably been discovered and described, approximately 250 new species are officially described by science each year.

The practice of ichthyology is associated with marine biology, limnology, and oceanography.

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    - 1.3 Mediterranean Era
    - 1.4 European Renaissance Era
    - 1.5 Exploration and Colonization Era
    - 1.6 Modern Era
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History

Ichthyology originates to the Upper Paleolithic Revolution to the present day. This science was developed in several interconnecting epochs, each with various significant advancements.

Pre-historical Era

(38,000 BC–1500 BC)

Fish compose approximately 8% of all figurative depictions on Mimbres pottery.

The study of fish receives its origins from the human desire to feed, clothe, and equip themselves with useful implements. According to Michael Barton, a prominent ichthyologist and professor at Centre College, "The earliest ichthyologists were hunters and gatherers who had learned how to obtain the most useful fishes, where to obtain them in abundance, and at what times they might be the most available." These insights of early cultures were manifested in abstract and identifiable artistic expressions.

Judeo-Christian Era

(1500 BC–40 AD)

Informal, scientific descriptions of fish are represented within the Judeo-Christian tradition. Moses, in the development of the kashrut, forbade the consumption of fish without scales or appendages. Theologians and ichthyologists speculate that the apostle Peter and his contemporaries harvested the fish that are today sold in modern industry along the Sea of Galilee, presently known as Lake Kinneret. These fish include cyprinids of the genus Barbus and Mirogrex, cichlids of the genus Sarotherodon, and Mugil cephalus of the family Mugilidae.

Mediterranean Era

(335 BC–80 AD)

Aristotle incorporated ichthyology into formal scientific study. Between 335 BC–322 BC, he provided the earliest taxonomic classification of fish, in which 117 species of Mediterranean fish were accurately described. Furthermore, Aristotle observed the anatomical and behavioral differences between fish and marine mammals. Proceeding his death, some of his pupils continued his ichthyological research. Theophrastus, for example, composed a treatise on amphibious fish. The Romans, although less devoted to the pursuit of science, wrote extensively about fish. Pliny the Elder, a notable Roman naturalist, compiled the ichthyological works of indigenous Greeks, including verifiable and ambiguous peculiarities such as the sawfish and mermaid respectively. Pliny's documentation was the last significant contribution to ichthyology until the European Renaissance.

European Renaissance Era

(13th–16th century)

The writings of three sixteenth century scholars, Hippolyte Salviani, Pierre Belon, and Guillaume Rondelet, signify the conception of modern ichthyology. The investigations of these individuals were based upon actual research in comparison to ancient recitations. This property popularized and emphasized these discoveries. Despite their prominence, Rondelet's De Piscibus Marinum is regarded as the most influential, identifying 244 species of fish.

Exploration and Colonization Era

(16th–17th century)

The incremental alterations in navigation and shipbuilding throughout the Renaissance marked the commencement of a new epoch in ichthyology. The Renaissance culminated with the era of exploration and colonization, and upon the cosmopolitan interest in navigation came the specialization in naturalism. Georg Marcgrave of Saxony composed the Naturalis Brasilae in 1648. This document contained a description of 100 species of fish indigenous to the Brazilian coastline. In 1686, John Ray and Francis Willughby collaboratively published Historia Piscium, a scientific manuscript containing 420 species of fish, 178 of these newly discovered. The fish contained within this informative literature were arranged in a provisional system of classification.

The classification used within the *Historia Piscium* was invented by Carolus Linnaeus, the "father of modern taxonomy". His taxonomic approach became the systematic approach to the study of organisms, including fish. Linnaeus was a professor at the University of Uppsala and an eminent botanist; however, one of his colleagues, Peter Artedi, earned the title "father of ichthyology" through his indispensable advancements. Artedi contributed to Linnaeus's refinement of the principles of taxonomy. Furthermore, he recognized five additional orders of fish: Malacopterygii, Acanthopterygii, Branchiostegi, Chondropterygii, and Plagiuri. Artedi developed standard methods for making counts and measurements of anatomical features that are modernly exploited. Another associate of Linnaeus, Albertus Seba, was a prosperous pharmacist from Amsterdam. Seba assembled a cabinet, or collection, of fish. He invited Artedi to utilize this assortment of fish; unfortunately, in 1735, Artedi fell into an Amsterdam canal and drowned at the age of 30.

Linnaeus posthumously published Artedi's manuscripts as *Ichthyologia, sive Opera Omnia de Piscibus* (1738). His refinement of taxonomy was culminated subsequent to the development of the binomial nomenclature which is in use by contemporary ichthyologists. Furthermore, he revised the orders introduced by Artedi, placing significance on pelvic fins. Fish lacking this appendage were placed within the order Apodes; fish containing abdominal, thoracic, or jugular pelvic fins were termed Abdominales, Thoracici, and Jugulares respectively. However, these alterations were not grounded within the evolutionary theory. Therefore, it would take over a century until Charles Darwin would provide the intellectual foundation from which we would be permitted to perceive that the degree of similarity in taxonomic features was a consequence of phylogenetic relationship.

Modern Era

(17th century–Present)

Close to the dawn of the nineteenth century, Marcus Elieser Bloch of Berlin and Georges Cuvier of Paris made an attempt to consolidate the knowledge of ichthyology. Cuvier summarized all of the available information in his monumental Histoire Naturelle des Poissons. This manuscript was published between 1828 and 1849 in a 22 volume series. This documentation contained 4,514 species of fish, 2,311 of these new to science. This piece of literature still remained one of the most ambitious treatises of the modern world. The scientific exploration of the Americas progressed our knowledge of the remarkable diversity of fish. Charles Alexandre Lesueur, a student of Cuvier, who made a cabinet of fish dwelling within the Great Lakes and Saint Lawrence River regions.

Adventurous individuals such as John James Audubon and Constantine Rafinesque figure in the faunal documentation of North America. These persons often traveled with one another and composed Ichthyologia Ohiensis in 1820. In addition, Louis Agassiz of Switzerland established his reputation through the study of freshwater fish and organisms and the pioneering of paleoichthyology. Agassiz eventually immigrated to the United States and taught at Harvard University in 1846.

Albert Günther published his Catalogue of the Fishes of the British Museum between 1859 and 1870, describing over 6,800 species and mentioning another 1,700. Generally considered one of the most influential ichthyologists, David Starr Jordan wrote 650 articles and books on the subject as well as serving as president of Indiana University and Stanford University.

Modern Publications

Publication	**Frequency**	**Date of Publication**	**Affiliated Company**
Copeia	Quarterly	27 December 1913	American Society of Ichthyologists and Herpetologists
Journal of Applied Ichthyology	Bi-monthly	Unknown	Blackwell Publishing

Organizations

Organizations

- American Elasmobranch Society
- American Fisheries Society
- American Society of Ichthyologists and Herpetologists
- Association for Systematics Collections
- Canadian Association of Aquarium Clubs
- Native Fish Conservancy
- Neotropical Ichthyological Association

Organizations

- North American Native Fishes Association
- Society for Integrative and Comparative Biology
- Society for Northwestern Vertebrate Biology
- Society for the Preservation of Natural History Collections
- Southeastern Fishes Council
- Southwestern Association of Naturalists
- The World Conservation Union

Notable ichthyologists

The names are followed by their fields of specialization and major contributions:

- Alexander Emanuel Agassiz
  Louis Agassiz
  HM Emperor Akihito of Japan
  Peter Artedi
  William O. Ayres - California
  Spencer Fullerton Baird
  Tarleton Hoffman Bean
  Lev Berg - Russia
  Pieter von Bleeker - East Indies
  Marcus Elieser Bloch
  George Albert Boulenger
  Edward Drinker Cope
  Georges Cuvier
  Francis Day - India
  Bashford Dean
  Carl H. Eigenmann
  Rosa Smith Eigenmann
  Samuel Garman
  Charles Henry Gilbert
  Theodore Nicholas Gill
  Charles Frédéric Girard
  George Brown Goode
  Albert Günther
  Carl L. Hubbs
  David Starr Jordan
  Seth Meek
  George S. Myers
  John Treadwell Nichols - China, founder of Copeia
  John Richardson Norman
  C. Tate Regan
  J.L.B. Smith
  Donn E. Rosen
  Edwin C. Starks
  Franz Steindachner
  Achille Valenciennes
  Francis Willughby

See also

- Ichthyology terms

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Electric fish

An **electric fish** is a fish that can generate electric fields. It is said to be electrogenic; a fish that has the ability to detect electric fields is said to be electroreceptive. Most fish that are electrogenic are also electroreceptive. Electric fish species can be found both in the sea and in freshwater rivers of South America and Africa. Many fishes such as sharks, rays and catfishes can detect electric fields, and are thus electroreceptive, but as they cannot generate an electric field they are not classified as electric fish. Most common bony fish (teleosts), including most fish that kept in aquaria or caught for food, are neither electrogenic nor electroreceptive.

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Strongly and weakly electric fish

Electric fish produce their electric fields from a specialized structure called an electric organ. This is made up of modified muscle or nerve cells, which became specialized for producing electric fields. Typically this organ is located in the tail of the electric fish. The electrcial output of the organ is called the *electric organ discharge* (EOD).

Fish that have an EOD that is powerful enough to stun their prey are called **strongly electric fish**. The amplitude of the signal can range from 10 to 500 volts with a current of up to 1 ampere. Typical examples are the electric eel (Electrophorus electricus; not a true eel but a knifefish), the electric catfishes (family Malapteruridae), and electric rays (order Torpediniformes).

By contrast, **weakly electric fish** generate a discharge that is typically less than one volt in amplitude. These are too weak to stun prey, but are used for navigation, object detection (electrolocation) and communication with other electric fish (electrocommunication). Some of the best known and most studied examples are Peters' elephantnose fish (*Gnathonemus petersi*) and the black ghost knifefish (*Apteronotus albifrons*).

The EOD waveform takes two general forms depending on the species. In some species the waveform is continuous and almost sinusoidal (for example the genera Apteronotus, Eigenmannia and Gymnarchus) and these are said to have a wave-type EOD. In other species, the EOD waveform consists of brief pulses separated by longer gaps (for example Gnathonemus, Gymnotus, Raja) and these are said to have a pulse-type EOD.

Table of electric fish

This is a table of all known electric fish species within fresh water. In salt water there is only one order, the Torpediniformes (electric rays), inside the chondrichthyes that shows species generating even strong electric pulses (genus Torpedo spp., which counts 22 known species).

Taxon	Species (348)
Gymnotiformes	
Apteronotidae (46 species in 13 genera)	*Adontosternarchus balaenops, Adontosternarchus clarkae, Adontosternarchus devenanzii, Adontosternarchus sachsi, Apteronotus albifrons, Apteronotus apurensis, Apteronotus bonapspeciesii, Apteronotus brasiliensis, Apteronotus caudimaculosus, Apteronotus cuchillejo, Apteronotus cuchillo, Apteronotus ellisi, Apteronotus eschmeyeri, Apteronotus jurubidae, Apteronotus leptorhynchus, Apteronotus macrolepis, Apteronotus macrostomus, Apteronotus magdalenensis, Apteronotus marauna, Apteronotus mariae, Apteronotus rostratus, Apteronotus spurrellii, Compsaraia compsa, Magosternarchus duccis, Magosternarchus raptor, Megadontognathus cuyuniense, Megadontognathus kaitukaensis, Orthosternarchus tamandua, Parapteronotus hasemani, Platyurosternarchus macrostomus, Porotergus gimbeli, Porotergus gymnotus, Sternarchella curvioperculata, Sternarchella orthos, Sternarchella schotti, Sternarchella sima, Sternarchella terminalis, Sternarchogiton nattereri, Sternarchogiton porcinum, Sternarchorhamphus muelleri,*

	Sternarchorhynchus britskii, Sternarchorhynchus curvirostris, Sternarchorhynchus mesensis, Sternarchorhynchus mormyrus, Sternarchorhynchus oxyrhynchus, Sternarchorhynchus roseni
Gymnotidae (29 species in 1 genus)	*Gymnotus anguillaris, Gymnotus arapaima, Gymnotus ardilai, Gymnotus bahianus, Gymnotus carapo, Gymnotus cataniapo, Gymnotus choco, Gymnotus coatesi, Gymnotus coropinae, Gymnotus cylindricus, Gymnotus diamantinensis, Gymnotus esmeraldas, Gymnotus henni, Gymnotus inaequilabiatus, Gymnotus javari, Gymnotus jonasi, Gymnotus maculosus, Gymnotus mamiraua, Gymnotus melanopleura, Gymnotus onca, Gymnotus panamensis, Gymnotus pantanal, Gymnotus pantherinus, Gymnotus paraguensis, Gymnotus pedanopterus, Gymnotus stenoleucus, Gymnotus sylvius, Gymnotus tigre, Gymnotus ucamara*
Electrophoridae (1 species in 1 genus)	*Electrophorus electricus*
Hypopomidae (14 species in 7 genera)	*Brachyhypopomus beebei, Brachyhypopomus brevirostris, Brachyhypopomus diazi, Brachyhypopomus janeiroensis, Brachyhypopomus occidentalis, Brachyhypopomus pinnicaudatus, Hypopomus speciesedi, Hypopygus lepturus, Hypopygus neblinae, Microsternarchus bilineatus, Racenisia fimbriipinna, Steatogenys duidae, Steatogenys elegans, Stegostenopos cryptogenes*
Rhamphichthyidae (15 species in 3 genera)	*Gymnorhamphichthys hypostomus, Gymnorhamphichthys petiti, Gymnorhamphichthys rondoni, Gymnorhamphichthys rosamariae, Iracema caiana, Rhamphichthys*

	apurensis, Rhamphichthys atlanticus, Rhamphichthys drepanium, Rhamphichthys hahni, Rhamphichthys lineatus, Rhamphichthys longior, Rhamphichthys marmoratus, Rhamphichthys pantherinus, Rhamphichthys rostratus, Rhamphichthys schomburgki
Sternopygidae **(28 species in 5 genera)**	*Archolaemus blax, Distocyclus conirostris, Distocyclus goajira, Eigenmannia humboldtii, Eigenmannia limbata, Eigenmannia macrops, Eigenmannia microstoma, Eigenmannia nigra, Eigenmannia trilineata, Eigenmannia vicentespelaea, Eigenmannia virescens, Rhabdolichops caviceps, Rhabdolichops eastwardi, Rhabdolichops electrogrammus, Rhabdolichops jegui, Rhabdolichops stewspeciesi, Rhabdolichops troscheli, Rhabdolichops zareti, Sternopygus aequilabiatus, Sternopygus arenatus, Sternopygus astrabes, Sternopygus branco, Sternopygus castroi, Sternopygus dariensis, Sternopygus macrurus, Sternopygus obtusirostris, Sternopygus pejeraton, Sternopygus xingu*
Osteoglossiformes	
Gymnarchidae **(1 species in 1 genus)**	*Gymnarchus niloticus*
Mormyridae **(203 species in 18 genera)**	*Boulengeromyrus knoepffleri, Brienomyrus adustus, Brienomyrus brachyistius, Brienomyrus curvifrons, Brienomyrus hopkinsi, Brienomyrus kingsleyae eburneensis, Brienomyrus kingsleyae kingsleyae, Brienomyrus longianalis, Brienomyrus longicaudatus, Brienomyrus niger, Brienomyrus sphekodes, Brienomyrus tavernei, Campylomormyrus alces, Campylomormyrus bredoi,*

Campylomormyrus cassaicus, Campylomormyrus christyi, Campylomormyrus curvirostris, Campylomormyrus elephas, Campylomormyrus luapulaensis, Campylomormyrus mirus, Campylomormyrus numenius, Campylomormyrus orycteropus, Campylomormyrus phantasticus, Campylomormyrus rhynchophorus, Campylomormyrus tamandua, Campylomormyrus tshokwe, Genyomyrus donnyi, Gnathonemus barbatus, Gnathonemus echidnorhynchus, Gnathonemus longibarbis, Gnathonemus petersii, Heteromormyrus pauciradiatus, Hippopotamyrus aelsbroecki, Hippopotamyrus ansorgii, Hippopotamyrus batesii, Hippopotamyrus castor, Hippopotamyrus discorhynchus, Hippopotamyrus grahami, Hippopotamyrus harringtoni, Hippopotamyrus macrops, Hippopotamyrus macroterops, Hippopotamyrus pappenheimi, Hippopotamyrus paugyi, Hippopotamyrus pictus, Hippopotamyrus psittacus, Hippopotamyrus retrodorsalis, Hippopotamyrus smithersi, Hippopotamyrus szaboi, Hippopotamyrus weeksii, Hippopotamyrus wilverthi, Hyperopisus bebe bebe, Hyperopisus bebe occidentalis, Isichthys henryi, Ivindomyrus opdenboschi, Marcusenius rhodesianus, Marcusenius sanagaensis, Marcusenius schilthuisiae, Marcusenius senegalensis gracilis, Marcusenius senegalensis pfaffi, Marcusenius senegalensis

senegalensis, Marcusenius stanleyanus, Marcusenius thomasi, Marcusenius ussheri, Marcusenius victoriae, Marcusenius abadii, Marcusenius annamariae, Marcusenius bentleyi, Marcusenius brucii, Marcusenius cuangoanus, Marcusenius cyprinoides, Marcusenius deboensis, Marcusenius dundoensis, Marcusenius friteli, Marcusenius furcidens, Marcusenius fuscus, Marcusenius ghesquierei, Marcusenius greshoffii, Marcusenius intermedius, Marcusenius kutuensis, Marcusenius leopoldianus, Marcusenius livingstonii, Marcusenius macrolepidotus angolensis, Marcusenius macrolepidotus macrolepidotus, Marcusenius macrophthalmus, Marcusenius mento, Marcusenius meronai, Marcusenius monteiri, Marcusenius moorii, Marcusenius ntemensis, Marcusenius nyasensis, Marcusenius rheni, Mormyrops anguilloides, Mormyrops attenuatus, Mormyrops batesianus, Mormyrops breviceps, Mormyrops caballus, Mormyrops citernii, Mormyrops curtus, Mormyrops curviceps, Mormyrops engystoma, Mormyrops furcidens, Mormyrops intermedius, Mormyrops lineolatus, Mormyrops mariae, Mormyrops masuianus, Mormyrops microstoma, Mormyrops nigricans, Mormyrops oudoti, Mormyrops parvus, Mormyrops sirenoides, Mormyrus bernhardi, Mormyrus caballus asinus, Mormyrus caballus bumbanus, Mormyrus caballus caballus, Mormyrus caballus lualabae, Mormyrus casalis, Mormyrus caschive, Mormyrus cyaneus, Mormyrus felixi, Mormyrus *goheeni, Mormyrus hasselquistii, Mormyrus iriodes, Mormyrus kannume, Mormyrus lacerda, Mormyrus longirostris, Mormyrus macrocephalus, Mormyrus macrophthalmus, Mormyrus niloticus, Mormyrus ovis, Mormyrus rume proboscirostris, Mormyrus rume rume, Mormyrus subundulatus, Mormyrus tapirus, Mormyrus tenuirostris, Mormyrus thomasi, Myomyrus macrodon, Myomyrus macrops, Myomyrus pharao, Oxymormyrus boulengeri, Oxymormyrus zanclirostris, Paramormyrops gabonensis, Paramormyrops jacksoni, Petrocephalus ansorgii, Petrocephalus balayi, Petrocephalus bane bane, Petrocephalus bane comoensis, Petrocephalus binotatus, Petrocephalus bovei bovei, Petrocephalus bovei guineensis, Petrocephalus catostoma catostoma, Petrocephalus catostoma congicus, Petrocephalus catostoma haullevillei, Petrocephalus catostoma tanensis, Petrocephalus christyi, Petrocephalus cunganus, Petrocephalus gliroides, Petrocephalus grandoculis, Petrocephalus guttatus, Petrocephalus hutereaui, Petrocephalus keatingii, Petrocephalus levequei, Petrocephalus microphthalmus, Petrocephalus pallidomaculatus, Petrocephalus pellegrini, Petrocephalus sauvagii, Petrocephalus schoutedeni, Petrocephalus simus, Petrocephalus soudanensis, Petrocephalus squalostoma, Petrocephalus sullivani, Petrocephalus tenuicauda, Petrocephalus wesselsi, Pollimyrus adspersus, Pollimyrus brevis, Pollimyrus castelnaui, Pollimyrus*

	isidori fasciaticeps, Pollimyrus isidori isidori, Pollimyrus isidori osborni, Pollimyrus maculipinnis, Pollimyrus marchei, Pollimyrus nigricans, Pollimyrus nigripinnis, Pollimyrus pedunculatus, Pollimyrus petherici, Pollimyrus petricolus, Pollimyrus plagiostoma, Pollimyrus pulverulentus, Pollimyrus schreyeni, Pollimyrus stappersii kapangae, Pollimyrus stappersii stappersii, Pollimyrus tumifrons, Stomatorhinus ater, Stomatorhinus corneti, Stomatorhinus fuliginosus, Stomatorhinus humilior, Stomatorhinus kununguensis, Stomatorhinus microps, Stomatorhinus patrizii, Stomatorhinus polli, Stomatorhinus polylepis, Stomatorhinus puncticulatus, Stomatorhinus schoutedeni, Stomatorhinus walkeri
Siluriformes	
Malapteruridae **(11 species in 1 genus)**	*Malapterurus beninensis, Malapterurus cavalliensis, Malapterurus electricus, Malapterurus leonensis, Malapterurus microstoma, Malapterurus minjiriya, Malapterurus monsembeensis, Malapterurus oguensis, Malapterurus shirensis, Malapterurus tanganyikaensis, Malapterurus tanoensis*

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Fishing

Fishing is the activity of hunting for fish. By extension, the term fishing is also applied to hunting for other aquatic animals such as various types of shellfish as well as squid, octopus, turtles, frogs and some edible marine invertebrates. The term fishing is not usually applied to the hunting of aquatic mammals such as whales. Fishing is an ancient and worldwide practice with various techniques and traditions and it has been transformed by modern technological developments. It has even became a sport of some account.

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Fishing in antiquity

Origins

"Fishing" is a very ancient practice that dates back at least to the Mesolithic period which began about 10,000 years ago.[1] Archaeological features such as shell middens,[2] discarded fish bones and cave paintings show that sea foods were important for survival and consumed in significant quantities. During this period, most people lived a hunter-gather lifestyle and were, of necessity, constantly on the move. However, where there are early examples of permanent settlements (though not necessarily permanently occupied) such as those at Lepenski Vir, they are almost always associated with fishing as a major source of food.

The Neolithic culture and technology spread worldwide between 4,000 and 8,000 years ago. With the new technologies of farming and pottery came basic forms of all the main fishing methods that are still used today.

Fishing may even pre-date the development of modern humans. The aquatic ape hypothesis, a controversial proposal, suggests that the ancestors of modern humans went through one or more periods of time living in a semi-aquatic setting and gathered most of their food from shallow coastal or other waters before their descendants returned to a more land-based existence.

Ancient representations

The ancient river Nile was full of fish; fresh and dried fish were a staple food for much of the population.[3] The Egyptians invented various implements and methods for fishing and these are clearly illustrated in tomb scenes, drawings, and papyrus documents. Simple reed boats served for fishing. Woven nets, weir baskets made from willow branches, harpoons and hook and line (the hooks having a length of between eight millimetres and eighteen centimetres) were all being used. By the 12th dynasty, metal hooks with barbs were being used. As is fairly common today, the fish were clubbed to death after capture. Nile perch, catfish and eels were among the most important fish. Some representations hint at fishing being pursued as a pastime.

Fishing scenes are rarely represented in ancient Greek culture, a reflection of the low social status of fishing. There is a wine cup, dating from 510–500 BC, that shows a boy crouched on a rock with a fishing-rod in his right hand and a basket in his left. In the water below, a rounded object of the same material with an opening on the top. This has been identified as a fish-cage used for keeping live fish, or as a fish-trap. It is clearly not a net. This object is currently in the Museum of Fine Arts, Boston.[4]

Pictorial evidence of Roman fishing comes from mosaics which show fishing from boats with rod and line as well as nets. Various species such as conger, lobster, sea urchin, octopus and cuttlefish are illustrated.[5] In a parody of fishing, a type of gladiator called retiarius was armed with a trident and a casting-net. He would fight against the murmillo, who carried a short sword and a helmet with the image of a fish on the front.

The Greco-Roman sea god Neptune is depicted as wielding a fishing trident.

Ancient literature

There are numerous references to fishing in ancient literature; in most cases, however, the descriptions of nets and fishing-gear do not go into detail, and the equipment is described in general terms. An early example from the Bible in Job 41:7: *Canst thou fill his skin with barbed irons? or his head with fish spears?*.[6]

The Greek historian Polybius (ca 203 BC-120 BC), in his Histories, describes hunting for swordfish by using a harpoon with a barbed and detachable head.[7]

Oppian of Corycus, a Greek author wrote a major treatise on sea fishing, the *Halieulica* or *Halieutika*, composed between 177 and 180. This is the earliest such work to have survived intact to the modern day. Oppian describes various means of fishing including the use of nets cast from boats, scoop nets held open by a hoop, spears and tridents, and various traps "which work while their masters sleep". Oppian’s description of fishing with a "motionless" net is also very interesting:

> *The fishers set up very light nets of buoyant flax and wheel in a circle round about while they violently strike the surface of the sea with their oars and make a din with sweeping blow of poles. At the flashing of the swift oars and the noise the fish bound in terror and rush into the bosom of the net which stands at rest, thinking it to be a shelter: foolish fishes which, frightened by a noise, enter the gates of doom. Then the fishers on either side hasten with the*

ropes to draw the net ashore.

From ancient representations and literature it is clear that fishing boats were typically small, lacking a mast or sail, and were only used close to the shore.

In traditional Chinese history, history begins with three semi-mystical and legendary individuals who taught the Chinese the arts of civilization around 2800–2600 BC: of these Fu Hsi was reputed to be the inventor of writing, hunting, trapping, and fishing.

Fishing techniques

Hand fishing

It is possible to fish with minimal equipment by using only the hands. In the USA catching catfish in this way is known as noodling. In the British Isles, the practice of catching trout by hand is known as trout tickling; it is an art mentioned several times in the plays of Shakespeare.

Trout binning is a method of fishing, possibly fictional, performed with a sledgehammer.[8]

Divers can catch lobsters by hand.

Pearl diving is the practice of hunting for oysters by free-diving to depths of up to 30 m.

Hand-line fishing is a technique requiring a fishing line with a weight and one or more lure-like hooks.

Catching fish by hand is currently illegal in the United States in the state of Kansas.

Spear and bow fishing

Spear fishing is an ancient method of fishing and may be conducted with an ordinary spear or a specialised variant such as an eel spear[9][10] or the trident. A small trident type spear with a long handle is used in the American South and Midwest for "gigging" bullfrogs with a bright light at night, or for gigging carp and other fish in the shallows.

Traditional spear fishing is restricted to shallow waters, but the development of the speargun has made the method much more efficient. With practice, divers are able to hold their breath for up to four minutes and sometimes longer; of course, a diver with underwater breathing equipment can dive for much longer periods.

Bow fishers use a bow and arrow to kill fish in shallow water from above.

Fishing nets

All fishing nets are meshes usually formed by knotting a relatively thin thread. Modern nets are usually made of artificial polyamides like nylon, although nets of organic polyamides such as wool or silk thread were common until recently and are still used in certain areas.

A small hand net held open by a hoop and possibly on the end of a long stiff handle has been known since antiquity and may be used for sweeping up fish near the water surface. Such a net used by an angler to aid in landing a captured fish is known as a landing net. In England, hand netting is the only legal way of catching eels and has been practised for thousands of years on the River Parrett and River Severn.

A casting net is circular with a weighted periphery. Sizes vary up to about 4 m diameter. The net is thrown by hand in such a manner that it spreads out on the water and sinks. Fish are caught as the net is hauled back in.[11]

Coracle-fishing is performed by two men, each seated in his coracle and with one hand holding the net while, with the other, he plies his paddle. When a fish is caught, each hauls up his end of the net until the two coracles are brought to touch and the fish is then secured.

The Chinese fishing nets (Cheena vala) found at Kochi in India are an example of shore operated lift nets.[12] Huge mechanical contrivances hold out horizontal nets of 20 m or more across. The nets are dipped into the water and raised again, but otherwise cannot be moved.

A seine is a large fishing net that may be arranged in a number of different ways. In purse seine fishing the net hangs vertically in the water by attaching weights along the bottom edge and floats along the top. A simple and commonly used fishing technique is beach seining, where the seine net is operated from the shore. Danish seine is a method which has some similarities with trawling.

Trawling is a method of fishing that involves actively pulling a fishing net through the water behind one or more boats.

A gillnet catches fish which try to pass through it by snagging on the gill covers. Thus trapped, the fish can neither advance through the net nor retreat.

Ghost nets are nets that have been lost at sea. They may continue to be a menace to wildlife for many years.

Dredging

There are types of dredges used for collecting scallops or oysters from the seabed. They tend to have the form of a scoop made of chain mesh and they are towed by a fishing boat. Scallop dredging is very destructive to the seabed, and nowadays is often replaced by mariculture or by scuba diving to collect the scallops.

Fishing lines

Fish are caught with a fishing line by encouraging a fish to bite upon a fish hook or a gorge. A fishing hook will pierce the mouthparts of a fish and may be barbed to make escape less likely. A gorge is buried in the bait such that it would be swallowed end first. The tightening of the line would fix it cross-wise in the quarry's stomach or gullet and so the capture would be assured.

Fishing with a hook and line is called angling. In addition to the use of the hook and line used to catch a fish, a heavy fish may be landed by using a landing net or a hooked pole called a gaff.

Trolling is a technique in which a fishing lure on a line is drawn through the water. Trolling from a moving boat is a technique of big-game fishing and is used when fishing from boats to catch large open-water species such as tuna and marlin. Trolling is also a freshwater angling technique most often used to catch trout. Trolling is also an effective way to catch northern pike in the great lakes. This technique allows anglers to cover a large body of water in a short time.

Long-line fishing is a commercial fishing technique that uses hundreds or even thousands of baited hooks hanging from a single line.

Snagging is a technique where the object is to hook the fish in the body. Generally, a large treble hook with a heavy sinker is cast into a river containing a large amount of fish, such as a Salmon, and is quickly jerked and reeled in. Due to the often illegal nature of this method some practitioners have added methods to disguise the practice, such as adding bait or reducing the jerking motion.

Kite fishing

Kite fishing is presumed to have been first invented in China. It was, and is, also used by the people of New Guinea and other Pacific Islands - either by cultural diffusion from China or independent invention.

Kites can provide the boatless fishermen access to waters that would otherwise be available only to boats. Similarly, for boat owners, kites provide a way to fish in areas where it is not safe to navigate such as shallows or coral reefs where fish may be plentiful. Kites can also be used for trolling a lure through the water.

Suitable kites may be of very simple construction. Those of Tobi Island are a large leaf stiffened by the ribs of the fronds of the coconut palm. The fishing line may be made from coconut fibre and the lure made from spiders webs.[13]

Modern kitefishing is popular in New Zealand, where large delta kites of synthetic materials are used to fish from beaches[1][2], taking a line and hooks far out past the breakers.

Ice fishing

Ice fishing is the practice of catching fish with lines and hooks through an opening in the ice on a frozen body of water. It is practised by hunter-gatherers such as the Inuit and by anglers in other cold or continental climates.

Fish traps

Traps are culturally almost universal and seem to have been independently invented many times. There are essentially two types of trap, a permanent or semi-permanent structure placed in a river or tidal area and pot-traps that are baited to attract prey and periodically lifted.

Indigenous Australians were, prior to European colonisation, most populous in Australia's better-watered areas such as the Murray-Darling river system of the south-east. Here, where water levels fluctuate seasonally, indigenous people constructed ingenious stone fish traps.[14] Unfortunately, most have been completely or partially destroyed. The largest and best known were the Brewarrina fish traps on the Barwon River at Brewarrina in New South Wales, which fortunately are at least partly preserved.[15] The Brewarinna fish traps caught huge numbers of migratory native fish as the Barwon River rose in flood and then fell. In southern Victoria, indigenous people created an elaborate systems of canals, some more than 2 km long. The purpose of these canals was the encouragement and catching of eels, a fish of short coastal rivers (as opposed to rivers of the Murray-Darling system). The eels were caught by a variety of traps including stone walls constructed across canals with a net placed across an opening in the wall. Traps at different levels in the marsh came into operation as the water level rose and fell. Somewhat similar stone wall traps were constructed by native American Pit River people in north-eastern California.[16]

A technique called dam fishing is used by the Baka pygmies. This involves the construction of a temporary dam resulting in a drop in the water levels downstream — allowing fish to be easily collected.[17]

In medieval Europe, large fishing weir structures were constructed from wood posts and wattle fences. 'V' shaped structures in rivers could be as long as 60 m and worked by directing fish towards fish traps or nets. Such fish traps were evidently controversial in medieval England. The Magna Carta includes a clause requiring that they be removed:

> *All fish-weirs shall be removed from the Thames, the Medway, and throughout the whole of England, except on the sea coast.*[18]

Basket weir fish traps were widely used in ancient times. They are shown in medieval illustrations and surviving examples have been found. Basket weirs are about 2 m long and comprise two wicker cones, one inside the other — easy to get into and hard to get out.[19]

The Wagenya people, in the Democratic Republic of Congo, build a huge system of wooden tripods across the river. These tripods are anchored on the holes naturally carved in the rock by the water current. To these tripods are anchored large baskets, which are lowered in the rapids to "sieve" the waters for fish. It is a very selective fishing, as these baskets are quite big and only large size fish are trapped. Twice a day the adults Wagenya people pull out these baskets to check whether there are any fish caught; in which case somebody will dive into the river to fetch it.

Lobster and crab pots

Pot traps are typically used to catch crustaceans such as crabs, lobsters and crayfish. Pot traps such as the lobster trap may be constructed in various shapes, each is a mesh box designed with a convoluted entrance that makes entry much easier than exit. The pots are baited and lowered into the water and checked daily. Similar traps are used in many areas to capture bait fish.

Trained animals

In China and Japan, the practice of cormorant fishing is thought to date back some 1300 years. Fishermen use the natural fish-hunting instincts of the cormorants to catch fish, but a metal ring placed round the bird's neck prevents large, valuable fish being swallowed. The fish are instead collected by the fisherman.[20]

The people of Nauru used trained frigatebirds to fish on reefs.

The practice of tethering a remora, a sucking fish, to a fishing line and using the remora to capture sea turtles probably originated in the Indian Ocean. The earliest surviving records of the practice are Peter Martyr d'Anghera's 1511 accounts of the second voyage of Columbus to the New World (1494).[21] However, these accounts are probably apocryphal, and based on earlier, no longer extant accounts from the Indian Ocean region.

Dating from the 1500s in Portugal, Portuguese Water Dogs were used by fishermen to send messages between boats, to retrieve fish and articles from the water, and to guard the fishing boats. Labrador Retrievers have been used by fishermen to assist in bringing nets to shore; the dog would grab the floating corks on the ends of the nets and pull them to shore.

Toxins

Many hunter gatherer cultures use poisonous plants to *stun* fish so that they become easy to collect by hand. Some of these poisons paralyse the fish, others are thought to work by removing oxygen from the water.[22]

Cyanides are used to capture live fish near coral reefs for the aquarium and seafood market. This illegal fishing occurs mainly in or near the Philippines, Indonesia, and the Caribbean to supply the 2 million marine aquarium owners in the world. Many fish caught in this fashion die either immediately or in shipping. Those that survive often die from shock or from massive digestive damage. The high concentrations of cyanide on reefs harvested in this fashion damages the coral polyps and has also resulted in cases of cyanide poisoning among local fishermen and their families.

Explosives

Dynamite or blast fishing, is done easily and cheaply with dynamite or homemade bombs made from locally available materials. Fish are killed by the shock from the blast and are then skimmed from the surface or collected from the bottom. The explosions indiscriminately kill large numbers of fish and other marine organisms in the vicinity and can damage or destroy the physical environment. Explosions are particularly harmful to coral reefs.[23] Blast fishing is also illegal in many waterways around the world.

Electrofishing

A relatively new fishing technique is electrofishing, typically used for stream classification surveys and catching brood stock for hatcheries, or making estimates of populations in a body of water. A gated pulse of direct current is used to cause muscular contractions in a fish, called galvanotaxis, causing them to turn towards the source of the electrical current and swim towards it when correct pulse speeds and durations are used, along with correct current.

A low voltage or short pulse with long gaps will cause the fish to swim away from the device, and high voltage or long pulses with short rests can cause galvanonarcosis, or unconsciousness. Techniques for setting pulse length and patterns, current and voltage require great skill to fish effectively without killing or injuring fish if they are to be left unharmed. Dissolved minerals in the water can decrease resistance causing less of the current to pass through the fish, whereas fish recently entering fresh water from the ocean have high salinity and are more prone to electric shock. Also the smaller the fish, and consequently the less surface area in contact with the water, the higher the current required to produce galvanotaxis. Smaller fish also require shorter pulses, closer together, while large fish should have longer pulses at lower power and longer gaps between pulses.

Rigs can be battery powered back-packs or powered by a generator if they are mounted in a boat. They are typically equipped with a "dead-man switch" and a tilt switch to disable the device if the unit is tipped or the operator incapacitated. Protective equipment must be worn to isolate the operator and prevent electrocution.

Electro-fishing is also used to illegally catch Razorfish or Spoots, using a boat based generator. Current is passed into the sediment causing the Razorfish to 'jump' and be harvested by divers. For obvious reasons this method of electro-fishing is banned due to the risk to the divers.

Modern fishing

Recreational fishing

Main article: Angling

Recreational fishing and the closely related (nearly synonymous) sport fishing describe fishing for pleasure or competition. Recreational fishing has conventions, rules, licensing restrictions and laws that limit the way in which fish may be caught, The International Game Fishing Association (IGFA) makes and oversees these obligations. Typically, these prohibit the use of nets and the catching of fish with hooks not in the mouth.

The most common form of recreational fishing is done with a rod, line and hooks attached to any of a wide range of lures or baits. Most types of fishing tackle are made in a professional manufacturing facility and other for hobbyist enjoy making their own baits, examples would include the use of Fishing worm molds, etc. This practice is known as angling.

One method of growing popularity is kayak fishing. Kayak fisherman fish from sea kayaks in an attempt to level the playing field with fish and to further challenge their abilities. Kayaks are extremely stealthy and can allow anglers to reach areas unfishable from land or by conventional boat.

In angling, it is sometimes expected or required that fish all be returned to the water (catch and release). The practice, however, is viewed by some with disapproval as they consider it unethical to inflict pain on a fish for fun or sport and not for reasons of capturing food. Anglers deny this charge, pointing out that fish commonly feed on hard and spiky prey items, and as such can be expected to have tough mouths, and also that some fish will re-take a lure they have just been hooked on, a behavior that is unlikely if being hooked were painful. There is also some research that shows certain types of fish such as catfish, do not have nerves around their mouth. They most likely do not have nerves in their mouths due to the fact that they eat animals such as crawfish that can pinch.

In a real sense, the suitability of catch and release is an ethical consideration and, as such, a science-based conclusion on the issue is unavailable. Scientific studies show a wide range of survival, depending on species, environmental conditions, fish density and research design (methodology). The difficulty of doing such experiments is closely linked to the fact that negative effects of being exposed to fishing gears develop over a long time. Keeping fish trapped over a long period of time creates a lot of noise which makes it hard to single out the effect of the catch from the effect of the chosen methodology. Nevertheless, several studies have now returned very high survival rates (95%+) for species caught on fly and lures, which generally tend to hook fish in the mouth and thus aid catch and release fishing.

Proponents of catch and release also contend that the practice is increasingly necessary in order to conserve fish stocks in the face of burgeoning human populations, mounting fishing pressure and worsening habitat degradation. Opponents would prefer to ban or to severely restricting angling, a suggestion most anglers find unpalatable.

Recreational fishermen can have profound deleterious effects on fish stocks in commercial lakes, this is due to anglers with poor knowledge of how to protect the fish from damage or stress once out of the water. The fish which suffer most are those of large, slow growing species such as carp. The only way for growing numbers of recreational fishermen to continue fishing is to reduce their impact on fish populations or to increase the fish populations (e.g. by restocking). Catch and release, in combination with techniques such as strong tackle (to get fish in quickly, for release in good condition), careful handling of fish and barbless hooks (to reduce physical damage) and quick release lead systems such as the Korda quick release system or the E.S.P. variety may be useful tools in this endeavour.

Barbless hooks reduce damage to minimal levels, reduce de-hooking time and greatly aid in catch and release. Many keen catch and release anglers use barbless hooks. Barbless hooks can be purchased, or created by crushing the barbs on a normal hook flat with a pair of needle-nosed pliers. It is popularly believed barbless hooks lead to more lost fish, but ensuring lures are equipped with split rings and keeping the line tight while fighting fish will reduce fish losses to levels similar to those of barbed hooks. Also using circle hooks will cause the least amount of damage to a fish. The design of the hook is very simple, it is like a circle. When a fish bites the bait the hook's design causes it to hook in the side of the fish's mouth every time. This makes it very easy to remove the hook with minimal damage. Setting your hook when a fish bites is also different. Instead of snatching your line you slowly set your hook. This alone is a lot less stressful on the fish. A circle hook is the best choice for catch and release programs.

A recent phenomenon of recreational fishing are fishing competitions (tournaments) where fishermen compete for prizes based on the total weight of a given species of fish caught within a predetermined time. This sport evolved from local fishing contests into large competitive circuits, especially in North America. Competitors are most often professional fishermen who are supported by commercial endorsements. Other competitions is purely on length with mandatory catch and release, either longest fish or total length is documented with camera and a mandatory sticker, is more fair since it's hard to weigh a living fish accurately in a boat.

Big-game fishing describes fishing from boats to catch large open-water species such as tuna, sharks and marlin.

Noodling and Trout tickling may be pursued as a recreation.

Laws made to control recreational fishing frequently also attempt to control the harvest of other aquatic species, such as frogs and turtles.

Commercial fishing

Main article: Fishing industry

Commercial fishing provides a large quantity of food to many countries around the world, but those who practice it as an industry must often pursue fish far into the ocean under adverse conditions. Commercial fishermen harvest almost all aquatic species, from tuna, cod and salmon to shrimp, krill, lobster, clams, squid and crab, in various fisheries for these species. Commercial fishing methods have become very efficient using large nets and sea-going processing factories. Many new restrictions are often integrated with varieties of fishing allocation schemes (such as individual fishing quotas), and international treaties that have sought to limit the fishing effort and, sometimes, capture efficiency.

Fishing methods vary according to the region, the species being fished for, and the technology available to the fishermen. A commercial fishing enterprise may vary from one man with a small boat with hand-casting nets or a few pot traps, to a huge fleet of trawlers processing tons of fish every day.

Commercial fishing gears today are surrounding nets (e.g. purse seine), seine nets (e.g. beach seine), trawls (e.g. bottom trawl), dredges, hooks and lines (e.g. long line and handline), lift nets, gillnets, entangling nets and traps.

In addition to the above, commercial fishing can also be thought of as encompassing "pay to fish" enterprises, which provide anglers with controlled access to stocked lakes, ponds or canals. These provide fishing opportunities outside of the permitted seasons and quotas applied to public waters. In the United Kingdom, commercial fisheries of this sort charge access fees, with prices ranging from £2 to £25 per day. In North America, establishments usually charge for the fish caught, by length or by weight, rather than for access to the site although some establishments charge both types of fees. Prices for fish caught in North American "pay to fish" waters are generally in the range of $0.10 to $0.20 per cm or from $5.00 to $10.00 per kg.

Preservation

Ancient methods of preserving fish included drying, salting, pickling and smoking. All of these techniques are still used today but the more modern techniques of freezing and canning have taken on a large importance.

See:

- Haddock: Arbroath Smokie (lightly smoked).
  Herring: kipper (salted and smoked), surströmming (fermented), rollmops (pickled), soused (salted).
  Salmon: smoked salmon, cured salmon, and gravlax (fermented).
  Cod: stockfish (air dried), lutefisk (soaked in lye).

In the past, fishing vessels were restricted in range by the simple consideration that the catch must be returned to port before it spoils and becomes worthless. The development of refrigeration and freezing technologies transformed the commercial fishing industry: fishing vessels could be larger, spending more time away from port and therefore accessing fish stocks at a much greater distance. Refrigeration and freezing also allow the catch to be distributed to markets further inland, reaching customers who previously would have had access only to dried or salted sea fish.

Canning, developed during the 19th century has also had a significant impact on fishing by allowing seasonal catches of fish that are possibly far from large centres of population to be exploited. For example: sardines.

Fish products

Food

The flesh of many fish are primarily valued as a source of food; there are many edible species of fish as well as other sea food.

Shellfish include shelled molluscs and crustaceans used as food. Shelled molluscs include the clam, mussel, oyster, winkle and scallop; some crustaceans are the shrimp, lobster, crayfish, and crab.

Eggs, called roe, of various species may be eaten; roe comes from fish and certain marine invertebrates, such as sea urchins and shrimp. In some cultures, roe is considered a delicacy, for example caviar from the sturgeon.

Squid and octopus are valued as food.

Sea cucumber is considered a delicacy in Chinese cooking and is often served at New Year's feasts, usually in soups.[24]

In some cultures, for example China, Japan, and Vietnam, certain species of jellyfish are consumed.[25]

Fish oil is valued as a dietary supplement.

Live fish

Live fish are collected for the international live food fish trade. Some seafood restaurants keep live fish in aquaria for display or for cultural beliefs. The majority of live fish kept at seafood restaurants, however, are desired for the freshness of the seafood, being killed only immediately before being cooked. Suiting customer preference, this practice makes the seafood higher in quality and better in taste. The prevalence of cultural beliefs and consumer standards helps to drive the demand for the live food fish trade. Hong Kong, for example, is estimated to have imported in excess of 15,000 tonnes of live food fish in 2000. This brought the value of their live food fish trade industry to US$400 million as reported by the World Resources Institute.[26]

Fish can also be collected in ways that do not injure them such as in a seine net or by placing an electric current into the water. Such techniques are used most often by researchers for observation and study but are also used by those who collect fish for the aquarium trade. There are several organizations devoted to improving the methods of collecting, handling, transporting, exporting and farming of wild and domesticated live food fish, as well as freshwater and marine tropical fish destined for aquaria.

Other products

Pearls and mother-of-pearl are valued for their lustre. Traditional methods of pearl hunting are now virtually extinct.

Sharkskin and rayskin which are covered with, in effect, tiny teeth (dermal denticles) were used for the purposes that sandpaper currently is. These skins are also used to make leather. Sharkskin leather is used in the manufacture of hilts of traditional Japanese swords.

Sea horse, star fish, sea urchin and sea cucumber are used in traditional Chinese medicine.

Tyrian purple is a pigment made from marine snails Murex brandaris and Murex trunculus.

Sepia is a pigment made from the inky secretions of cuttlefish.

Fish glue is made by boiling the skin, bones and swim bladders of fish. Fish glue has long been valued for its use in all manner of products from illuminated manuscripts to the Mongolian war bow.

Isinglass is a substance obtained from the swim bladders of fish (especially sturgeon), it is used for the clarification of wine and beer.

Fish emulsion is a fertilizer emulsion that is produced from the fluid remains of fish processed for fish oil and fish meal industrially.

Cultural references

Fishing is a widely used as a metaphor though as such it is possibly ambiguous. On the one hand, fishing with a net has nuances of gathering by honest effort. For example, in the New Testament, Jesus is reported to have said to his disciples: *Follow me, and I will make you fishers of men.* Matthew 4:19.

On the other hand, fishing with bait or lure sometimes has nuances of catching by deception, possibly with an implication of greed on the part of the victim. For example, the expression "fishing expedition" (usually used to describe a line of questioning), describes a case where the questioner implies that he knows more than he actually does in order to trick the target into divulging more information than he wishes to reveal. Other examples of fishing terms that carry a negative connotation are: "fishing for compliments", "to be fooled hook, line and sinker" (to be fooled beyond merely "taking the bait"), and the internet scam of Phishing.

- Aquaculture
  Chinese fishing nets
  Clam digging
  Environmental effects of fishing
  Fish farming
  Fishing light attractor
  FishBase
  Fishery
- Fishing industry
- Fish market
- Lobster fishing
- Whaling
- Fishing rod
  Sport Fishing
  Luxury resorts
  Phishing

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Fisherman

A Long Island fisherman cleans his nets

A **fisherman** (in recent years sometimes called a **fisher** to be non-gender specific), is a person who engages in the activity of fishing. The word can mean these types:-

- People who fish as their profession. They may belong to a cooperative, corporation, or union. These are nearly always men.
- People who fish for subsistence.
- People who fish to teach others how to fish.
- People who fish for sport, such as most anglers (who fish with a hook).

See also

- Fishing

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Fishing industry

The **fishing industry** is the commercial activity of fishing and producing fish and other seafood products for human consumption or as input factors in other industrial processes. According to Food and Agriculture Organization (FAO) statistics the total fish production in the world in 2001 was 130 million tonnes. In addition to the commercial catches, 37.9 million tonnes were produced in aquaculture plants.

In the 1990s and 2000s it has become increasingly evident that industrial fishing has severely depleted stocks of certain types of ocean fish, such as cod. For more information, see overfishing.

One fishing industry sector that appears to remain in a good state of production is the freshwater fishing sector in Canada. The Manitoba commercial fishing industry is comprised of over 3,600 fisherpersons who produce 25 percent of Canada's freshwater catch. Lake Winnipeg is the biggest contributor of commercially landed fish species. Of the 13 fish species commercially harvested, pickerel (walleye), Sauger, lake whitefish, northern pike, yellow perch and lake trout are the most highly valued species. Others include white sucker, tullibee, carp, burbot, lake sturgeon, Goldeye and white bass.

See also

- Ichthyology (the study of fish)

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Fish market

A **fish market** is a marketplace used for the trade in and sale of fish and other seafood. It can be dedicated to wholesale trade between fishermen and fish merchants, or to the sale of seafood to individual consumers, or to both.

Fish market can also refer to the market for fish products in general, but this article is concerned with physical marketplaces.

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- 1 History and development
- 2 Notable fish markets
  - 2.1 Operative markets
  - 2.2 Historical markets

History and development

Because seafood is quick to spoil, fish markets are historically most often found in seaside towns, but (if ice or other simple cooling methods were available) some were also established in large inland cities that had good trade routes to the coast.

Since refrigeration and rapid transport became available in the 19th and 20th century, fish markets can technically be established at any place. However, because modern trade logistics in general has shifted away from marketplaces and towards retail outlets, such as supermarkets, most seafood worldwide is now sold to consumers through these venues, like most other foodstuffs.

Consequently, most major fish markets now mainly deal with wholesale trade, and the existing major fish retail markets continue to operate as much for traditional reasons as for commercial ones. Both types of fish markets are often tourist attractions as well.

Notable fish markets

The following is an incomplete list of notable fish markets.

Operative markets

- Billingsgate Fish Market, London, United Kingdom
  Busan Cooperative Fish Market, Busan, South Korea
  Fulton Fish Market, New York, USA
  Maine Avenue Fish Market, Washington, D.C., USA
  Tsukiji fish market, Tokyo, Japan; the world's largest fish market
  Feskekôrka, Gothenburg, Sweden.

Historical markets

- Scania Market, a historical annual market at the Falsterbo Peninsula

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Whaling

The crew of the oceanographic research vessel "Princesse Alice," of Albert Grimaldi (later Prince Albert I of Monaco) pose while flensing a catch.

Whaling refers to the practice, history and industries associated with the hunting and killing of whales. In recent history (most notably during the 19th and the earlier part of 20th centuries), total lack of conservation management led to severe over-killing of whale populations, and to endangerment of three whale species (Blue, Sei, and Fin) and 3 population segment within right and gray whale species according to IUCN.

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History of whaling

It is unknown when humans began hunting whales. The earliest archaeological record of whaling is found in South Korea where carved drawings, dating back to 6,000 BC, show that Stone Age people hunted whales using boats and spears. However, over time, whaling techniques have grown more technologically sophisticated. Initially, whaling was confined to (near) coastal water, such as the Basque fishery targeting the Atlantic Northern right whale around 15th to 18th century and the Atlantic Arctic fishery around and in between Spitzbergen and Greenland from around the 17th to the 20th century. However, after the emergence of modern whaling techniques, certain species of whale started to be seriously affected by whaling. These techniques were spurred in the 19th century by the increase in demand for whale oil, and later in the 20th century by a demand for whale meat.

Whaling history has affected both the development of many cultures as well as their environment.

Iceland

Iceland has not a long tradition of subsistence whaling, although they have a long tradition of using whale products. Indeed, whaling of one form or another has been conducted from the middle ages, not by the Icelanders but by other nations such as Spain. The early reliance on whales is reflected in the Icelandic language - *hvalreki* is the word for both "beached whale" and "gained luck" as the Icelanders often could benefit from a stranded whale, since Iceland became populated more than eleven hundred years ago and throughout the middle ages.

Modern whaling in Iceland began in 1883 by the Norwegeans. By 1915, they had taken at least 17,000 from Icelandic waters. The Icelandic Government banned whaling in its waters to allow time for population recovery. The law was repealed in 1928.

By 1947, Icelanders had set up their own commercial whaling operation for the first time. They hunted mostly sei, fin, and minke whales. In the very early years of this operation, a few blue, sperm, and humpback whales were also hunted, but this was soon prohibited by the Icelandic Government due to decimated numbers. Between 1947 and 1985, Icelandic whalers killed around 20,000 animals in total.

Japan

Harpooning of whales by hand began in Japan in the 12th century, but it was not until the 1670s, when a new method of catching whales using nets was developed, that whaling really began to spread throughout Japan. In the 1890s Japan followed international trends, first switching to modern harpoon whaling techniques, and eventually to factory ships for mass whaling. In the postwar 1940s and 1950s, whale meat became a primary source of food and protein in Japan following the famines that came with World War II. In many whaling nations, the discovery of petroleum products that could replace the industrially important parts of whales, such as the oil, resulted in a decline in the importance and levels of whaling. This was not the case in Japan, however, where whale meat was an important food source, and where the whaling industry was a source of pride in a country that is dependent on food importation to feed its populace.

United States

The whaling history of the United States can be roughly divided into two parts: native whaling and commercial whaling (though overlaps exist). Native whaling is a tradition which reaches back to the early Inuit of North America hundreds of years before the colonization by Europeans.[1] Commercial whaling in the United States was the center of the world whaling industry during the 18th and 19th centuries and was most responsible for extinction or near-extinction of certain species of whales. New Bedford, Massachusetts and Nantucket Island were the primary whaling centers in the 1800s. In 1857, New Bedford had 329 registered whaling ships. Prior to the 1920's when commercial whaling in the United States waned, as petroleum products began replacing oil derived from whales, numerous fishing ports were actually whaling ports which built whaling ships.

The primary focus of whaling in the United States was the lamp oil made from the prodigious amount of fat contained in whales. The whaling ships carried rendering equipment which rendered fat from the carcasses as soon as it was raised onto the ships. Aside from the fat and certain bones, the majority of carcass was generally thrown back in the water, as there was no market for whale meat. Whale oil was, at that time, the highest quality oil for lamps.

The discovery of petroleum in Pennsylvania in the late 19th century was the beginning of the end of commercial whaling in the

United States as kerosene, distilled from crude oil, replaced whale oil in lamps. Later, electricity gradually replaced oil lamps, and by the 1920's, the demand for whale oil had disappeared entirely.

Today, the New Bedford Whaling National Historical Park commemorates the heritage of both commercial and native whaling in the United States at its locations in New Bedford and Barrow, Alaska.

Modern whaling

Whale oil is little used today, thus modern whaling has primarily commercial value as a food source. The primary species hunted is the minke whale, the smallest of the baleen whales. Recent scientific surveys estimate a population of 180,000 in the central and North East Atlantic and 700,000 around Antarctica.

International cooperation on whaling regulation started in 1931 and a number of multi-lateral agreements now exist in this area, the International Convention for the Regulation of Whaling (ICRW) of 1946 being the most important. The International Whaling Commission (IWC) was founded by the ICRW for the purpose of giving management advice to the member nations on the basis of the work of the Scientific Committee. Countries which are not members of IWC are not bound by its regulation and conduct their own management program.

The members of the IWC voted on 23 July 1982 to enter into a moratorium on all commercial whaling beginning in the 1985-86 season. Since 1992, the IWC Scientific Committee has requested of the IWC that it be allowed to give quota proposals for some whale stocks, but this has so far been refused by the IWC. Norway legitimately continues to hunt minke whales commercially under IWC regulation, as it has lodged an objection to the moratorium.

Canadian whaling

Canada left the IWC in 1982 and as such is not bound by the morartorium on whaling. Canadian whaling is carried out by various Inuit groups around the country in small numbers and is managed by the Department of Fisheries and Oceans. The meat obtained from these whaling are commercially sold through shops and supermarket. There is considerable consternation amongst conservationists about the hunt. The Whale and Dolphin Conservation Society says "Canada has pursued a policy of marine mammal management which appears to be more to do with political expediency rather than conservation."

Caribbean whaling

Some whaling is conducted from Grenada, Dominica and Saint Lucia. Species hunted are the Short-finned Pilot Whale, Pygmy Killer

Whale and Spinner Dolphins. Throughout the Caribbean, around 400 Pilot Whales are killed annually. The meat is sold locally. This hunting of small cetaceans is not regulated by the IWC.

Faroe Islands

Grindadráp is whaling in the Faroe Islands. It has been practiced since at least the 10th century. It is regulated by Faroese authorities but is not approved by the International Whaling Commission. The hunts are regulated by the division of the Faroes into 11 whaling districts, with a total of 23 authorised whaling bays. The hunts are opportunistic and there are no quotas set for the species taken. Around one thousand Long-finned Pilot Whales Globicephala melas are harvested and several hundred white-sided dolphins Lagenorhynchus acutus throughout the year. The grindadráp mainly takes place during the summer. The hunt is non-commercial, and anyone can participate. Grindadráp works by surrounding the whales with a wide semi-circle of boats and slowly driving them into a bay or fjord and then onto a beach.

Toothed whales and dolphins carry high levels of mercury, PCBs and other pollutants. The sheer volume of polluted whale and dolphin meat distributed among the 43,000 or so population of the Faroe Islands is of concern from a human health perspective.

Greenlandic whaling

Greenland Inuit whalers kill around 170 whales per year, making them the third largest hunt in the world after Norway and Japan, though their take is only about one quarter of either Japan's or Norway's, which take 600 or more whales each year. The IWC treats the west and east coasts of Greenland as two separate population areas and sets separate quotas for each coast. The far more densely populated west coast accounts for over 90% of individuals caught. In a typical year around 150 Minke and 10 Fin Whales are taken from west coast waters and around 10 Minkes are from east coast waters.

Iceland

Unlike Norway, Iceland did not lodge an objection against the IWC moratorium, which came into force in 1986. Between 1986 and 1989 around 60 animals per year were taken under a scientific permit. However, under strong pressure from anti-whaling countries, viewing scientific whaling as a circumvention of the moratorium, Iceland ceased whaling altogether in 1989. Following the 1991 refusal of the

IWC to accept its Scientific Committee's recommendation to allow sustainable commercial whaling, Iceland left the IWC in 1992.

Iceland rejoined the IWC in 2002 with a reservation to the moratorium. This reservation is not recognized by anti-whaling countries. In 2003 Iceland resumed scientific whaling. Iceland presented a feasibility study to the 2003 IWC meeting to take 100 minke, 100 fin, and 50 sei in each of 2003 and 2004. The primary aim of the study was to deepen the understanding of fish-whale interactions - the strongest advocates for a resumed hunt are fisherman concerned that whales are taking too many fish. The hunt was supported by three-quarters of the Icelandic population. Amid concern from the IWC Scientific Committee about the value of the research and its relevance to IWC objectives (no decision on the proposal was reached. However under the terms of the convention the Icelandic government issued permits for a scientific catch. In 2003, Iceland took 36 minke whales from a quota of 38. In 2004, it took 25 whales (the full quota). In 2005, the government issued a permit for a third successive year - allowing whalers to take up to 39 whales.

Iceland resumed commercial whaling in 2006. The annual quota is set to 30 minke whales (out of an estimated 174 thousand animals in the North Atlantic) and nine fin whales (out of an estimated 30 thousand animals in the North Atlantic). Iceland broke the IWC ban on commercial whaling on 22 October 2006 after Icelandic fishermen killed a sixty ton female fin whale.[2]

Indonesian whaling

Lamalera, on the south coast of the island of Lembata, and Lamakera on neighboring Solor are the last two remaining Indonesian whaling communities. The hunters have religious taboos that ensure that they use every part of the animal. About half of the catch is kept in the village; the rest is traded in local markets, using barter. In 1973, the UN's Food and Agriculture Organization sent a whaling ship and a Norwegian master whaler, to modernize the hunt. This effort lasted three years, and was not successful. According to the FAO report, the Lamalerans "have evolved a method of whaling which suits their natural resources, cultural tenets and style."

Japan

When the commercial whaling moratorium was introduced by the

IWC in 1982, Japan lodged an official objection, but withdrew this objection in 1987 after the United States threatened it with sanctions. Thus, Japan became bound by the moratorium, unlike Norway, Russia and (more disputed) Iceland. Therefore, in 1987, Japan stopped commercial whaling activities in Antarctic waters, but in the same year began a controversial scientific whaling program (JARPA - **Ja**panese **R**esearch **P**rogram in **A**ntarctica).

The Japanese government mainly justifies this type of whaling on the grounds that analysis of stomach contents provides insight into the dietary habits of whales and that analysis of actual tissue is the only way to ascertain the age of a whale as well as the degree of interbreeding in the population which provides vital insight into whale population distribution.

Japan's scientific whaling program has remained controversial, with anti-whaling groups maintaining that the killing of whales is unnecessary for scientific purposes and that the real reason for the scientific kills is to provide whale meat for Japanese restaurants and supermarkets. Countries opposed to whaling have raised similar concerns and passed non-binding resolutions in IWC urging Japan to stop this program. The Japanese government points out that hunting of whales for research purposes is specifically sanctioned under IWC regulations and that those regulations specifically require that whale meat be fully utilised upon the completion of research.

In 1994, Australia attempted to stop some of the Japanese whaling program by enforcing a 200 nautical mile exclusive economic zone (EEZ) around the Australian Antarctic Territory. However, Antarctic territories are not generally recognized internationally. In particular, the Antarctic Treaty, to which Australia is a signatory, specifically states that all claims to Antarctic territories remain unresolved while the treaty is in force. (The treaty was originally devised to prevent conflict between the USSR and USA during the Cold War.) Legal advice obtained by the Australian government indicated that attempts to stop Japanese whaling in the Australian Antarctic Territory by resorting to international courts may, in fact, have led to Australia losing its claim to that territory.

In 2002, Japanese whalers took five sperm, 39 sei, 50 Bryde's and 150 Minke whales in the northern catch area and 440 minke whales in the southern catch area. The catch was carried out under the IWC's special licence for whaling research. In 2005 Japan announced that they would significantly expand their whaling. With the adoption of this plan, Japan’s lethal take will include 100 sei whales, 10 sperm whales, 50 humpback whales, 50 fin whales, and 50 Bryde’s whales, some of which are considered endangered, along with 1,155 minke whales.

The most vocal opponents of the Japanese push for a resumption of commercial whaling are Australia and the United States, whose stated purpose for opposing whaling is the need for conservation of endangered species.

Refer to International Whaling Commission for more details on controversy surrounding the Japanese whaling program.

Norway

Norway has registered an objection to the International Whaling Commission moratorium, and is thus not bound by it. In 1993, Norway resumed a commercial catch, following a period of five years where a small catch was made under a scientific permit. The catch is made solely from the Northeast Atlantic Minke whale population, which is estimated to consist of about 110,000 animals. Norwegian Minke whale catches have fluctuated between 503 animals in 1997 to 639 in 2005.

Prior to the moratorium, Norway caught around 2,000 Minkes per year. The North Atlantic hunt is divided into five areas and usually lasts from early May to late August. Norway exports a limited amount of whale meat to the Faroes and Iceland. It has been attempting to export to Japan for several years, though this has been hampered by legal protests and concerns in the Japanese domestic market about the effects of pollution in the blubber of the North Atlantic Minke whale.

In May 2004, the Norwegian Parliament passed a resolution to considerably increase the number of minkes hunted each year. The Ministry of Fisheries also proposed a satellite tracking programme to monitor numbers of other species as possible prelude to resuming hunting of them.

Russian whaling

Russians in Chukotka Autonomous Okrug in the Russian Far East are permitted under IWC regulation to take up to 140 Gray Whales from the North-East Pacific population each year.

United States whaling

In the United States whaling is carried out by Alaska Natives from nine different communities in Alaska. The whaling programme is managed by the Alaska Eskimo Whaling Commission which reports to the National Oceanic and Atmospheric Administration. The hunt takes around 50 Bowhead Whales a year from a population of about 8,000 in Alaskan waters. Conservationists fear this hunt is not sustainable, though the IWC Scientific Committee, the same group that provided the above population estimate, projects a population growth of 3.2% per year. The hunt also took an average of one or two Gray Whales each year until 1996. The quota was reduced to zero in that year due to concerns about sustainability. A review set to take place in the future may result in the hunt being resumed.

The Makah tribe in Washington State also reinstated whaling in 1999, despite intense protests from animal rights groups.

Bycatch and illegal trade

Since the IWC moratorium, there have been several instances of illegal whale kills by IWC nations. In 1994, the IWC reported evidence from genetic testing[3] of whale meat and blubber for sale on the open market in Japan in 1993.[10] In addition to the legally-permitted minke whale, the analyses showed that the 10-25% tissues sample came from non mink, baleen whales species, neither of which were then allowed for take under the IWC rules. Further reaserch in 1995 and 1996 shows significant drop of non-minke baleen whales sample to 2.5%. [11] In a separate paper, Baker stated that "many of these animals certainly represent a bycatch (incidental entrapment in fishing gear)" and stated that DNA monitoring of whale meat is required to adequately track whale products. [12]

It was revealed in 1994 that the Soviet Union had been systematically underreporting the number of whales it took. For example, from 1948 to 1973, the Soviet Union killed 48,477 humpback whales rather than the 2,710 it officially reported to the IWC.[4] On the basis of this new information, the IWC stated that it would have to rewrite its catch figures for the last forty years.[5] According to Ray Gambell, the Secretary of the IWC at the time, the organisation had raised its suspicions of underreporting with the former Soviet Union, but it did not take further action because it could not interfere with national sovereignty.[6]

In 1985, an activist organization, Earthtrust, placed undercover employees on Korean fishing vessels who took photographs of both fin and right whales being hunted and processed in violation of the ban.

The arguments for and against whaling

Conservation status

The sharpest point of debate over whaling today concerns the conservation status of hunted species. Today there is widespread agreement around the world that it is morally wrong to exterminate a species of animal. The unregulated whaling before IWC introduced regulation and ban has depeleted the overall whale population to a significant extent and several whales species were severely endangered. Past ban on these species of whales which were implemented around 1960s has helped some of these species to recover. According to IUCN's Cetacean Specialist Group (CSG)

"Several populations of southern right whales, humpbacks in many areas, grey whales in the eastern North Pacific, and blue whales in both the eastern North Pacific and central North Atlantic have begun to show signs of recovery." [13]

Other species, however, in particular the minke whale, have never been considered endangered and still other species or certain population group within particular whales species have shown signs of recovery.

Still, those opposed to whaling argue that a return to full-scale commercial whaling will lead to economic concerns overriding those of conservation, and there is a continuing battle between each side as to how to describe the current state of each species. For instance, conservationists are pleased that the sei whale continues to be listed as endangered but Japan says that the species has swelled in number from 9,000 in 1978 to about 28,000 in 2002 and so its catch of 50 sei whales per year is safe, and that the classification of endangered should be reconsidered for the north Pacific population.

Some North Atlantic states have argued that fin whales should not be listed as endangered anymore and criticize the list for being inaccurate.[14] IUCN has recorded studies showing that more than 40,000 individuals are present in the North Atlantic Ocean around Greenland, Iceland, and Norway.[15] As there is no information about fin whales in areas outside of the Northern Atlantic they still hold the status of being endangered.

A complete list of whale conservation statuses as listed by The World Conservation Union (IUCN) is given below. Note that, in the case of the blue and gray whales, the IUCN distinguishes the statuses of various populations. These populations, while not regarded as separate species, are considered sufficiently important in term of conservation.

Extinct	Critically Endangered	Endangered	Vulnerable	Lower Risk (Conservation Dependent)	Lower Risk (Near Threatened)	Lower Risk (Least Concern)
None	Gray Whale	Blue Whale	Beluga	Antarctic Minke Whale	Minke Whale	Dwarf Sperm Whale

Blue Whale [illegible]
musculus [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
Gray Whale *Pacific*
Northeast population [illegible]
Northern Bottlenose Whale
Southern Bottlenose Whale
Short-finned Pilot Whale
Southern Right Whale

Additionally, the IUCN notes that the Atlantic population of gray whales was made extinct around the turn of the eighteenth century.

Method of killing

Farming whales in captivity has never been attempted and would almost certainly be logistically impossible. Instead, whales are killed at sea often using explosive harpoons, which puncture the skin of the whale and then explode inside the body. Anti-whaling groups say this method of killing is cruel, particularly if carried out by inexperienced gunners, because the whale can take several minutes or even hours to die. In March 2003, Whalewatch, an umbrella group of 140 conservation and animal welfare groups from 55 countries published a report, Troubled Waters, whose main conclusion was that whales cannot be guaranteed to be killed humanely and that all whaling should be stopped. They quoted figures that said 20% of Norwegian and 60% of Japanese-killed whales failed to die as soon as they had been harpooned. John Opdahl of the Norwegian embassy in London responded by saying that Norwegian authorities worked with the IWC to develop the most humane killing methods. He said that the average time taken for a whale to die after being shot was the same as or less than that of animals killed by big game hunters on safari. Whalers also say that the free-roaming lifestyle of whales followed by a quick death is less cruel than the long-term suffering of factory-farmed animals.

The pro-whaling High North Alliance points to apparent inconsistencies in the policies of some anti-whaling nations. For instance, the United Kingdom allows the commercial shooting of deer without these shoots adhering to the standards of British slaughterhouses, but says that whalers must meet these standards as a pre-condition before they would support whaling. Moreover, fox hunting, in which foxes are mauled by dogs, is legal in many anti-whaling countries including Ireland, the United States, Australia, Portugal, Italy and France according to UK Government's Burns Inquiry (2000). This inconsistency is used to argue that whales are the equivalents of cows in India and the cruelty argument is a mere expression of cultural bigotry, similar to the Western attitude towards the eating of dog meat in several East Asian countries.

The economic argument

The anti-whaling side of the argument often argues that the killed whales are those that are most curious about boats and thus the easiest to approach and kill. However, these individuals are also the most valuable to the whale-watching industry in coastal areas, as these "friendly" whales represent the easiest means of providing an experience to their customers. The argument over whether whales are worth more dead than alive is complex and unresolved. The whale-watching industry, and those opposed to whaling on moral grounds, claim that once all benefits to local economies such as hotels, restaurants and other tourist amenities are factored in, and the fact that a whale can only be killed once but watched many times, the economic balance weighs firmly down on the side of not hunting whales. This economic argument is a particular bone of contention in Iceland, which has amongst the most-developed whale-watching operations in the world and where hunting of minke whales began again in August 2003. The argument is less applicable to the Antarctic waters as minke whales are more abundant there, and there are far fewer whale-watching cruises. Many developing countries such as Brazil, Argentina and South Africa argue that whalewatching, a growing billion-dollar industry, provides more revenue and more equitable distribution of profits than the possible resumption of commercial whaling by pelagic fleets from far-away developed countries. These countries are defending their right to the non-lethal use of whale resources and refuse to bow down to the pressures of the whaling industry to allow the resumption of commercial whaling in their regions. Aside from Indonesia, no country in the Southern Hemisphere is currently whaling or intends to, and proposals to permanently forbid whaling South of the Equator are defended by the abovementioned developing countries plus Peru, Uruguay, Australia, and New Zealand, which strongly object to the continuation of Japanese whaling in the Antarctic.

The pro-whaling side claims that the debate is moot. They point out that anti whaling argument implies that hunt is done on unsustainable basis and the context of the debate itself is slanted toward anti-whaling rhetoric. Whalers argue that if whales are hunted on a sustainable basis, the argument that the whale-watching industry and whaling industry is in competition is invalid. Whales are the largest animals in the world, a single whale kill provides more meat in absolute terms than any other animal. Whaling and its associated activities continue to provide employment and economic stimulant for fishery, logistic, restaurant and other related industries. Whales are an excellent source of protein and animal fat. Whale blubber can be converted into valuable oleochemicals while the unused portions of the whale carcass can be rendered into meat and bone meal.

Whaling side has no objection to use of whales as tourist attraction which is another way to utilise whales as a resource. Moreover, for poorer whaling nation, the need for resumption of whaling are more pressing. Horace Walters, from the Eastern Caribbean Cetacean Commission stated, "We have islands which may want to start whaling again - it's expensive to import food from the developed world, and we believe there's a deliberate attempt to keep us away from our resources so we continue to develop those countries' economies by importing from them." Anti-whaling groups claim that developing countries which support pro-whaling stance may hurt their tourism industry. In reference to pro whaling Caribbean islands, Joth Singh, director of wildlife and habitat for the International Fund for Animal Welfare, stated "Individuals for whom whaling is abhorrent will think twice about going to a destination where their values are not shared." This position are echoed by governments opposed to whaling. Britain's environment minster, Ben Bradshaw stated "There can be a backlash by British consumers,". Danielle Grabiel, American observer of IWC from the Environmental Investigation Agency, also stated "Americans feel very strongly about their love for the whales, and I wouldn't be surprised if they decided not to see their money go to countries that support a return to commercial whaling," Saint Lucia's fisheries chief, Ignatius Jean, in response stated "We have heard these threats before, but we will not cower,". Still, The Dominica Hotel and Tourism Association called for "Caribbean governments to abandon pro-whaling positions and to propose a new regional whale sanctuary to promote the fast-growing pastime of whale watching."

Intelligence

The issue of the extent of whale intelligence has also been debated, primarily by those opposed to commercial whaling. The idea is that it is unethical to eat intelligent animals, as they are closer to humankind than other animals. Some advocates believe that whales' intelligence levels are on par with those of humans, but current level of scienctic research does not substantiate such claim though some research has shown that whales are highly "social" animals. How to classify animals by intelligence is a different issue, but this issue has been overshading the question related to if it is unethical to eat intelligent animals or not.

Most of the research on cetacean intelligence has consisted of behavioral inference tests carried out on dolphins. Bottlenose dolphins, for example, are able to recognize their own images in a mirror. However, in other research, they scored lower than ferrets in a test of learning set formation. Generally, both dolphin and pig intelligence is rated as higher than that of dogs and lower than human. On the other hand, it is nearly impossible to duplicate these types of tests for whales.

Regardless, many anti-whaling campaigners claim that cetaceans are still among the most intelligent of all nonhumans, and it is therefore morally wrong to kill them for food. However, those in favor of whaling point out that pigs are also amongst the most intelligent of animals with no definitive study indicating that whales are more intelligent than pig. Then it is inconsistent to claim that pigs can be used for food, and whales not, all other considerations notwithstanding. Thus, in the view of pro-whalers, if the slaughter and consumption of another "intelligent" land animal is a non-issue, then similarly, protestations against the slaughter and consumption of whales cannot logically be ground on the basis of intelligence. Moreover, this apparent inconsistency is seen as another indication that anti whaling argument is rooted in cultural prejudice.

Further, it is philosophically questionable as to whether the intelligence of an animal is a valid measure of the ethical acceptability of killing it. A logical extension of this belief would be to suggest that within a species, individuals who are more intelligent have more right to life. This would be considered entirely immoral in a human society. According to this argument, the intelligence of an animal should not be considered when deciding whether or not it is ethical to kill it for food. It is important, however, to discriminate between 'intelligence' and other factors that may affect the ability of the animal to experience pain and suffering, such as the possession of a complex central nervous system which almost all mammals possess.

Safety of eating whale meat

Studies of several species have shown that whale meat products often contain pollutants such as PCBs, mercury, and dioxins. An analysis of commercially sold whale meat in Japan found similar results. Studies on the red meat and blubber of long finned pilot whales in the Faroe islands show high toxin levels and studies have shown that this has had a detrimental effect on those who eat the red meat and blubber. However, studies of minke whales hunted in both the North Atlantic and the southern ocean have shown that the red meat of some minke whale individuals have levels of toxicity below recommended limits, with the Antarctic minke having the lowest levels of contamination.

In general, studies have shown that levels of some pollutants in toothed whale products are higher than corresponding levels in baleen whales , reflecting the fact that toothed whales feed at a higher trophic level than baleen whales in the food chain. However, other contaminants such as the organochloride pesticides HCH and HCB have comparable levels in both toothed and baleen species, including minke whales . In Norway, another whaling nation, only the red meat of minke whales is eaten and studies indicate that average toxicity levels conform to national limits for toxicity (P224)

Fishing

Whalers say that whaling is an essential condition for the successful operation of commercial fisheries, and thus the plentiful availability of food from the sea that consumers have become accustomed to. This argument is made particularly forcefully in Atlantic fisheries, for example the cod-capelin system in the Barents Sea. A minke whale's annual diet consists of 10 kilograms of fish per kilogram of body mass (Sigurjonsson and Vikingsson, 1997), which puts a heavy predatory pressure on commercial species of fish. Thus, whalers say that an annual cull of whales is needed in order for adequate amounts of fish to be available for humans. Anti-whaling campaigners say that the pro-whaling argument is inconsistent: If the catch of whales is small enough not to negatively affect whale stocks, it is also too small to positively affect fish stocks. To make more fish available, they say, more whales will have to be killed, putting populations at risk. Additionally, often whale feeding grounds and commercial fisheries do not overlap.

Professor Daniel Pauly, Director of the Fisheries Center at the University of British Columbia weighed into the debate in July 2004 when he presented a paper to the 2004 meeting of the IWC in Sorrento. Pauly's primary research is the decline of fish stocks in the Atlantic, under the auspices of the Sea Around Us Project. This report was commissioned by Humane Society International, an active anti-whaling lobby. The report stated that although cetaceans and pinnipeds are estimated to eat 600 million tonnes of food per year, compared with just 150 million tonnes eaten by humans (These are Pauly's figures. Researchers at the Institute for Cetacean Research gave figures of 90m tonnes for humans and 249-436m tonnes for cetaceans. Reference, the type of much of the food that cetaceans eat (in particular, deep sea squid and krill) is not consumed by humans. Moreover, the reports says, the locations where whales and humans catch fish only overlap to a small degree. In an interview with the BBC, Pauly stated that "The bottom line is that humans and marine mammals can co-exist. There's no need to wage war on them in order to have fish to catch. And there's certainly no cause to blame them for the collapse of the fisheries. It's really cynical and irresponsible for Japan to claim that the developing countries would benefit from a cull of marine mammals. It's the rich countries that are sucking the fish out of the poor countries' own seas." In the report Pauly also considers more indirect effects of whales' diet on the availability of fish for fisheries. He continues to conclude that whales are not a significant reason for diminished fish stocks.

However, the dietary behaviour of whales differ among species as well as season, location and availability of prey. For example, sperm whales' prey primarily consists of mesopelagic squid. However, in Iceland, they are reported to consume mainly fish (Sigurjónsson, et al 1998). Minke whales are known to eat a wide range of fish species including krill, capeline, herring, sand lance, mackerel, gadoids, cod, saithe and haddock (Haug et al, 1996). Minke whales are estimated to consume 633,000 tons of Atlantic herring per year in part of Northeast Atlantic (Folkow et al, 1997). In the Barents Sea, it is estimated that a net economic loss of five tons of cod and herring per fishery results from every additional Minke Whale in the population due the fish consumption of the single whale (Schweder, et al, 2000).

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Recreational fishing

Fishing from a pier

Angling is a form of fishing. It is often used synonymously with the terms sport fishing and recreational fishing, although subtle semantic distinctions exist among the three terms. Specifically, angling is the practice of catching fish by means of an "angle" (hook). The hook is usually attached by a line to a fishing rod. A bite indicator such as a float is sometimes, but not always, used. Frequently, the rod is outfitted with a fishing reel that functions as a mechanism for storing, retrieving and paying out the line. The hook can be dressed with lures or bait. Generally, angling is thought of, principally, as a method of sport fishing but some commercial fisheries use methods which are quite similar.

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- 2 Fishing techniques for fresh waters in temperate climes
- 3 Responsible use of bait fish
- 4 A brief note on saltwater fishing
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- 6 Catch and release
- 7 Criticism
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Introduction

The use of the hook in angling is descended, historically, from what would today be called a "gorge." The word "gorge", in this context, comes from an archaic word meaning "throat." Gorges were used by ancient peoples to capture fish. A gorge was a long, thin piece of bone or stone attached by its midpoint to a thin line. The gorge would be fixed with a bait so that it would rest parallel to the lay of the line. When a fish would swallow the bait, a tug on the line would cause the gorge to orient itself at right angles to the line, thereby sticking in the fish's gullet.

Angling, insofar as it can be considered equivalent to recreational or sport fishing, is a popular activity in many parts of the world. The species of fish pursued by anglers vary greatly with geography. Among the many species of salt water fish that are caught for sport are swordfish, marlin, tuna, salmon and halibut. In North America, the most popular fresh water sport species include bass, pike, walleye, muskellunge, yellow perch, trout, salmon, catfish, crappie, bluegill and sunfish. In Europe, a large number of anglers fish for species such as carp, pike, tench, rudd, roach, European perch and barbel (especially in stillwaters). Although some fish are sought for their value as food, others are pursued for their fighting abilities or for the difficulty of pursuit..

Which of the various techniques an angler may choose is dictated mainly by the target species and by its habitat. Angling can be separated into two distinct categories: using either artificial or natural baits.

The natural bait angler, with few exceptions, will use a common prey species of the fish as an attractant. The natural bait used may be alive or dead. Common natural baits include worms, leeches, minnows, frogs, salamanders, and insects. Natural baits are effective due to the lifelike texture, odour and colour of the bait presented, and require a relatively simple presentation.

By contrast, the artificial bait angler uses a man-made lure that may or may not represent prey. The lure may require a specialised presentation to impart an enticing action as, for example, in fly fishing.

Laws and regulations managing angling vary greatly, often regionally, within countries. These commonly include permits (licences), closed periods (seasons) where specific species are unavailable for harvest, restrictions on gear types, and quotas. For instance, an angler in the UK is legally required to hold a permit which allows the angler to fish with two rods for non-migratory fish. Any fish captured must be returned to the water otherwise unharmed. In most jurisdictions, there are legal penalties associated with breaching the regulations. In general, anglers are strongly advised to check and become fully aware of all angling laws and regulations in a local area before setting out to fish.

Laws generally prohibit catching fish with hooks other than in the mouth (snagging) or the use of nets other than as an aid in landing a captured fish. Some species, such as bait fish, may be taken with nets, and a few for food. Sometimes, (non-sport) fish are considered of lesser value and it may be permissible to take them by methods like snagging, bow and arrow, or spear. None of these techniques fall under the definition of angling since they do not rely upon the use of a hook and line.

Sometimes considered within the broad category of angling is a fairly recent phenomenon where contestants compete for prizes based on the total weight of fish, usually of a pre-determined species, caught within a specified time (fishing tournaments). Such contests have evolved from local fishing contests into large competitive circuits, where professional anglers are supported by commercial endorsements. Professional anglers are not generally considered to be engaged in commercial fishing, even though they gain an economic reward. Similar competitive fishing exists at the amateur level with local fishing derbies. In general, derbies are distinguished from tournaments; derbies normally require fish to be killed. Tournaments normally deduct points if fish can not be released alive.

Fishing techniques for fresh waters in temperate climes

When fishing, keep at some distance from the fish's expected location, so that your shadow does not fall upon the water and spook your prey. Most anglers also discourage, for similar reasons, laughter, stomping the ground, or loud conversation.

If the water is still, use smaller pieces of bait; if there is a strong current, use large pieces; do this quietly and cautiously because fish can feel vibrations around them and can actually see forms, movement and shadows above the water. It is generally accepted that fish in heavily fished waters become more wary and, consequently, more resistant to capture.

When the wind blows right across the water, fish with your back to the wind, as you will not only be able to throw your line better, but the fish will be on that side, attracted by the flies and other natural bait which the wind will blow into it.

The common earthworm is a universal bait for fresh water angling. Worms can be found in dark damp areas or at night when they surface to conjugate. In attempting to capture earthworms as bait, be aware that they are sensitive to light; the use of a red lens on a flashlight filters the light to wavelengths not detectable by the worm. If a worm senses the light from an unfiltered flashlight, it will quickly seek refuge in its burrow in the earth. Grubs and maggots are considered excellent bait when trout fishing; they can be collected in freshly ploughed earth, under old stumps, under decaying foliage, in rotting animal flesh, etc. Grasshoppers, bees and even ants are also used as bait for trout in their season, although many anglers believe that trout or salmon roe is superior to any other bait.

Many people prefer to fish solely with lures, which are artificial baits designed to entice fish to strike. A common way to fish a soft plastic worm is the Texas Rig.

Responsible use of bait fish

The capture, transportation and culture of bait fish are means by which exotic species of fish and other nuisance organisms are spread between fresh water environments. The irresponsible use and handling of bait fish has caused severe damage to aquatic ecosystems. Using exotic species as bait is generally not recommended.

Conscious effort to maintain a healthy ecosystem is always a factor on reponsible bait use. Like avoiding emptying bait buckets into fishing venues at the end of the day, considering the environment when collecting bait, and avoiding overharvested bait fish areas. That also includes the avoidance of causing severe damage on river banks and stream beds in search for earthworms or other invertebrates.

Awareness that transportation of fish from one location to another can contravene the law and the introduction of fish alien to the vicinity can be a concern since it may introduce diseases and parasites from other areas.

A brief note on saltwater fishing

For saltwater fishing, shrimp is the leading bait. The shedder crab, in its season, is most effective, particularly for striped bass. The soft shell clam, cut in small pieces, is good bait for many kinds of sea fish. Bait fish, whole or cut, and squid and octopus, whole or cut, are also popular saltwater baits.

Preparing roe as a bait

As mentioned above, roe is an excellent bait for trout and salmon. These are also effective baits for many other fresh water fish besides trout. Many anglers preserve it as follows: place the roe, either as separated (ovulated) eggs or as whole skeins (ovaries), in warm water (not hot enough to scald), remove any remnants of the filamentous supporting membranes, rinse well in cold water, and allow to dry. The next day, salt it with 60 g of table salt and 10 g of saltpeter to 500 g of roe. Let it stand another day and then spread it to dry. When it becomes stiff, you can then use it as bait. Many anglers will tie the roe into small nylon bags (4 to 8 eggs per bag, depending on size.) This is ideal for trout, and indeed for almost any fresh water fish.

Catch and release

Catch and release fishing is increasingly practiced, especially by fly anglers. The general principle is that releasing fish allows them to survive, thus avoiding unintended depletion of the population. For species such as marlin and muskellunge but, also, among few bass anglers, there is a cultural taboo against killing fish for food.

The practice of catch and release is abhorred by those who consider it unethical to inflict pain upon a fish for purposes of sport. Some of those who object to releasing fish do not object to killing fish for food.

Adherents of catch and release dispute this charge, pointing out that fish commonly feed on hard and spiky prey items, and as such can be expected to have tough mouths, and also that some fish will retake a lure they have just been hooked on, a behaviour that is unlikely if hooking were painful.

A definitive science-based conclusion on the issue is unavailable. However, a 2006 study suggested that many fish die because of the stress and injuries inflicted by catch-and-release fishing. Fish were tracked after being caught in a La Crosse, WI fishing tournament. Within a few days, hundreds of the fish were found dead, many from Largemouth Bass virus. According to media reports, Largemouth Bass virus "can cause death when the fish is stressed." [1] On the other hand a number of UK carp waters contain fish that have been caught and released so many times that they have been given names!

Opponents of catch and release fishing would find it preferable to ban or to severely restrict angling. On the other hand, proponents would appeal to the idea that burgeoning human populations place increasing stresses on fish populations and that restricting angling is not reasonable.

In some jurisdictions, in the Canadian province of Manitoba, for example, catch and release is mandatory for some species. Many of the jurisdictions which mandate the live release of sport fish also require the use of artificial lures and barbless hooks to minimise the chance of injury to fish.

Barbless hooks, which can be purchased from major manufacturers or which can be created from a standard hook by removing the barb with pliers, are sometimes resisted by anglers because they believe that increased escapement is the inevitable result. Barbless hooks reduce handling time, thereby increasing survival. Concentrating on keeping the line taut while fighting fish, using recurved point or "triple grip" style hooks on lures, and equipping lures that do not have them with split rings can significantly reduce escapement.

Criticism

Animal protection advocates have tried to raise awareness about the "suffering" of fish caused by angling. In light of recent research, some countries, like Germany, have banned specific types of fishing and the British RSPCA now formally prosecutes individuals who are cruel to fish. [2] Experiments done by William Tavolga provide evidence that fish have pain and fear responses. For instance, in Tavolga's experiments, toadfish grunted when electrically shocked and over time they came to grunt at the mere sight of an electrode. [3] Additional tests conducted at both the University of Edinburgh and the Roslin Institute, in which bee venom and acetic acid was injected into the lips of rainbow trout, resulted in fish rubbing their lips along the sides and floors of their tanks in an effort to relieve themselves of the pain.[4] Dr. Lynne Sneddon wrote "Our research demonstrates nociception and suggests that noxious stimulation in the rainbow trout has adverse behavioral and physiological effects. This fulfils the criteria for animal pain." [5] Dr. Donald Broom at Cambridge University states, “The scientific literature is quite clear. Anatomically, physiologically and biologically, the pain system in fish is virtually the same as in birds and mammals."[6]

However Professor James Rose of the University of Wyoming emphasizes the distinction between reaction to injury and psychological experience of pain. He points out that the absence of a neocortex in the fish brain means that fish lack the means to experience pain in the same way as humans. [7]

See also

- Fishing
- Whaling
-

Edible fish

Fish as a food describes the edible parts of water-dwelling, cold-blooded vertebrates with gills, as well as certain other water-dwelling animals such as mollusks, crustaceans, and shellfish.

There are over 27,000 species of fish, making them the most diverse group of vertebrates. However, only a small number of the total species are commonly eaten. Fish are consumed as food all over the world, but fresh fish are moreso in areas close to seas, rivers, and lakes.

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- 4 Is fish meat?
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Common food fish

Some commonly harvested and eaten fish species include:

- Salmon
  Cod
  Anchovy
  Carp
  Tuna
  Trout
  Mackerel
  Snapper
  Dogfish
  Tilapia

Preserving fish for market

Fish are highly perishable, and must be kept alive or refrigerated or frozen soon after capture or harvest to remain safe for human consumption. Fish are also commonly preserved for long-term storage or wide distribution. Some fish, such as salmon, tuna and herring are cooked and canned, while desiccation (complete drying) is commonly used to preserve some food fish, such as cod and partial drying and salting is popular for the preservation of herring and mackerel, among other fish.

Preparation for consumption

Fish can be prepared in a variety of ways, including raw, baked, fried, grilled, and boiled. Fish may also be served along side or in a dish with other foods, like vegetables, or with various condiments.

Fishes[1], especially saltwater fishes, are high in Omega 3 fatty acids, which are heart-friendly, and a regular diet of fish is highly recommended. This is supposed to be one of the major causes of reduced risk for cardiovascular diseases in Eskimos. It has been suggested that the longer lifespan of Japanese and Nordic populations may be partially due to their higher consumption of seafood. The Mediterranean diet is likewise based on a rich intake of fish. Bangladeshis and Indian people from the states of West Bengal, Orissa, Goa, Karnataka, Andhra Pradesh and Kerala usually like to keep fish in their daily menu of foods. In India and Bangladesh fresh water fishes like Rohu and saltwater fishes like Hilsa are quite popular. Iceland, Japan and Portugal are the largest fish consumers per capita in the world. [1]

Is fish meat?

Some people do not consider fish to be meat like other animal flesh. Some examples include fish eaters who consider themselves vegetarians because they don't eat other kinds of animal flesh (though this is highly controversial among vegetarians), Catholics who ate fish on Fridays pre-Vatican II when they were expected to fast from other forms of flesh, and Muslims who keep halaal and Jews who keep kosher, neither of which treats fish the same as other forms of animal flesh.

Footnotes

1: The word "fish" can refer to both an organism and a species of fish (in addition to the meat of a fish). These two meanings have different plurals; two organisms are "two fish," while two species (like Rohu and Hilsa) are "two fishes." For more details on usage, see the main Fish article.

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Fishkeeping

Fishkeeping is a popular hobby concerned with keeping fish in the home aquarium or garden pond.

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Types of fishkeeping

The hobby can be broadly divided into three specific disciplines, freshwater, brackish, and marine (also called saltwater) fishkeeping. **Freshwater fishkeeping** is by far the most popular branch of the hobby, with even small pet stores often selling a variety of freshwater fish, such as goldfish, guppies, and angelfish. While most freshwater aquaria are set up as **community tanks** containing a variety of peaceful species, many aquarists keep single-species aquaria with a view to breeding. Livebearing fish such as mollies and guppies are among the species that are most easily raised in captivity, but aquarists also regularly breed numerous other species, including many types of cichlid, catfish, characin, and killifish.

Marine aquaria are generally more difficult to maintain and the livestock is significantly more expensive, and as a result this branch of the hobby tends to attract more experienced fishkeepers. However, marine aquaria can be exceedingly beautiful, due to the attractive colours and shapes of the corals and coral reef fish kept in them. Temperate zone marine fish are not as commonly kept in home aquaria, primarily because they do not do well at room temperature. An aquarium containing these coldwater species usually needs to be either located in a cool room (such as an unheated basement) or else chilled using a refrigeration device known as a 'chiller'.

Brackish water aquaria combine elements of both marine and freshwater fishkeeping, reflecting the fact that these aquaria contain water with a salinity in between that of freshwater and seawater. Fish kept in brackish water aquaria come from habitats with varying salinity, such as mangroves and estuaries and do not do well if permanently kept in freshwater aquaria. Although brackish water aquaria are not overly familiar to newcomers to the hobby, a surprising number of species prefer brackish water conditions, including the mollies, many gobies, some pufferfish, monos, scats, and virtually all the freshwater soles.

Fishkeepers are often known as **aquarists**, since many of them are not solely interested in keeping fish. Many fishkeepers create freshwater aquaria where the focus is on the aquatic plants rather than on the fish. Though known as the 'Dutch Aquarium' in some circles, in reference to the pioneering work carried out by European aquarists in designing these sorts of aquaria. In recent years, one of the most active advocates of the heavily planted aquarium is the Japanese aquarist Takashi Amano. Marine aquarists very often attempt to recreate the coral reef in their aquaria using large quantities of living rock, porous calcareous rocks encrusted with algae, sponges, worms, and other small marine organisms. Larger corals as well as shrimps, crabs, echinoderms, and molluscs are added later on, once the aquarium has matured, as well as a variety of small fish. Such aquaria are sometimes called 'reef tanks'.

Garden ponds are in some ways similar to freshwater aquaria, but are usually much larger and exposed to the ambient climatic conditions. In the tropics, tropical fish can be kept in garden ponds, but in the cooler regions temperate zone species such as goldfish, koi, and orfe are kept instead.

The origins of fishkeeping

Fish have been raised as food in pools and ponds for thousands of years. In Medieval Europe, carp pools were a standard feature of estates and monasteries, providing an alternative to meat on feast days when meat could not be eaten for religious reasons. Similarly, throughout Asia there is a long history of stocking rice paddies with freshwater fish suitable for eating, including various types of catfish and cyprinid. Particularly brightly coloured or tame specimens of fish in these pools have sometimes been valued as pets rather than food, and some of these have given rise to completely domesticated varieties, most notably the goldfish and the koi carp, which have their origins in China and Japan respectively.

Marine fish have been similarly valued for centuries, and many wealthy Romans kept lampreys and other fish in salt water pools. Cicero reports that the advocate Quintus Hortensius wept when a favoured specimen died, while Tertullian reports that Asinius Celer paid 8000 sesterces for a particularly fine mullet.

Modern fishkeeping

Although some tropical fish were kept in gas-heated tanks in Victorian times, tropical fishkeeping only really became popular from the 1930s onwards when devices like electric heaters and inexpensive glass aquaria became available. Air transportation has also made it possible for fish to be imported from many parts of the world rapidly and inexpensively. As a result, aquarists are routinely offered large numbers of freshwater fish collected from South America, South East Asia, and East Africa. However, the majority of freshwater fish sold to aquarists are commercially bred, primarily in South East Asia and Florida.

Marine fish are not easily bred in captivity, and only a few species, most notably seahorses and clownfish are farm-raised. Most are collected from coral reefs, in particular from South East Asia, the Red Sea, and the Caribbean.

The Fishkeeping Industry

Worldwide, the fishkeeping hobby is a multi-million dollar industry, and the United States is considered the largest market in the world, followed by Europe and Japan. In 1994, 56% of U.S. households had pets, and 10.6% owned ornamental freshwater or saltwater fish, with an average of 8.8 fish per household. In 1993, the retail value of the fish hobby in the United States was $910 million.

From 1989 to 1992, almost 79% of all U.S. ornamental fish imports arrived from Southeast Asia and Japan. Singapore, Thailand, the Philippines, Hong Kong, and Indonesia were the top five exporting nations. South America was the second largest exporting region, accounting for 14% of the total annual value. Colombia, Brazil, and Peru were the major suppliers. The remaining 7% of ornamental fish imports came from other regions of the world.

Approximately 201 million fish worth $44.7 million were imported into the United States in 1992. These fish comprised 1,539 different species; 730 freshwater species, and 809 saltwater species. The freshwater fish accounted for approximately 96% of the total volume and 80% of the total import value. Of the total of all trade, only 32 species had import values over $10,000. These top species were all of freshwater origin and accounted for 58% of the total imported value of the fish. The top imported species are the guppy, neon tetra, platy, betta, Chinese algae eater, and goldfish.

Several large companies are focused primarily or extensively on supplying the fishkeeping hobby, producing products such as fish food, medicine, and aquarium hardware. Among the largest of these are Eheim, Tetra, Sera, all based in Germany; Hikari, a Japanese company; Fluval, part of the Canadian Rolf C. Hagen group; Interpet, a British company that also owns the Red Sea brand; and the American company Aquarian, owned by Mars, Incorporated but usually trading under the Waltham petfoods brand.

Fish breeding

Fish breeding is a challenge that many aquarists find attractive. While some species reproduce freely in community tanks, most require special conditions, known as spawning triggers before they will breed. The majority of fish lay eggs, known as spawning and the juvenile fish that emerge are very small and need tiny live foods or their substitutes to survive. A fair number of popular aquarium fish are livebearers, and these fish produce small number of relatively large offspring, and these will usually take ground flake food straight away (see article on livebearing aquarium fish).

Conservation and science

According to the FAO, at least 90% of freshwater aquarium fish are captive bred. Nearly all marine ornamental fish are wild-caught. Fish are collected from the wild could provide a valuable source of income for people in regions where other high-value exports may be lacking. Catching fish in the wild could also reduce their population sizes, placing them in danger.

In theory, wild fish should be a good example of a renewable resource that places value on maintaining the integrity and diversity of the natural habitat: more and better fish can be exported from clean, pristine aquatic habitat than one that has been polluted or otherwise degraded. However, this has not been the case with industries such as fur trapping, logging, or fishing where a similar situation existed. Historically, wild resources have tended to be overexploited rather than managed (see Tragedy of the Commons). Moreover, in places where collecting for aquaria is very intensive, there is good evidence that collecting can result in a decline in fish populations. A particular notorious example is to be found on the Philippines, where overfishing and the widespread use of cyanide to stun the fish has caused a drastic decline in the diversity of the coral reef fish considered most desirable by aquarists.

On the other hand, breeding programs by aquarists have helped to preserve species that have become rare or extinct in the wild, most notably among the Lake Victoria cichlids. Some species of aquarium fish have also become important as laboratory animals, with cichlids and poecilids being especially important for studies on learning, mating, and social behaviour. Aquarists also observe a large number of fishes not otherwise studied, and thereby provide valuable data on the ecology and behaviour of many species.

Animal Welfare

At its best, a properly maintained aquarium allows the fish to socialise with their own kind and in many cases breed successfully. This is in marked contrast to the conditions enjoyed by larger animals like cats and dogs, which are often kept alone and neutered, and thus unable to experience anything like a natural lifestyle. However, in many cases fish are maintained in the wrong conditions and therefore live short lives and never breed. Inexperienced aquarists often attempt to keep too many fish in their tanks, or introduce too many fish into an immature aquarium, with the result that large numbers of fish sicken and die. This has given the hobby a bad reputation among some animal welfare groups, such as PETA, for treating aquarium fish as nothing more than cheap toys that are simply replaced when they die.

Marine fish in particular tend to be less resilient during transportation than freshwater fish, and relatively large numbers of them die before they are finally sold to the aquarist. Although the trade in marine fish and corals for aquaria probably represents a minor threat to coral reefs when compared with habitat destruction, fishing for food, and climate change, it is a booming trade and may be a serious problem in specific locations such as the Philippines and Indonesia where most of the collecting is done.

Goldfish and bettas in particular have often been kept in cramped bowls or aquaria that are really far too small for their needs. In some cases fish have been installed in all sorts of inappropriate objects such as the **AquaBabies Micro Aquaria**, **Bubble Gear Bubble Bag** and **Betta in a Vase**, all of which contain live fish housed in unfiltered and entirely too small quantities of water. The **Betta in a Vase** is sometimes marketed as a complete ecosystem if a plant is included in the neck of the vase, some sellers claiming the fish will eat the roots of the plant. However, bettas are carnivorous and need to be fed live food or pellet foods as they cannot survive on plant roots. Another problem is if the plant blocks the bettas passage to the water surface, as they are labyrinth fishes, and need to be able to take breaths at the surface of the water or else they will die from suffocation. These types of products are not really aimed at aquarists but rather at people looking for a novelty gift, and in fact most aquarists abhor them. Similarly, the awarding of goldfish as prizes at funfairs is traditional in many parts of the world, but has been criticised by aquarists and animal welfare charities alike as cruel and irresponsible, and giving away live-animal prizes such as goldfish was made illegal in the UK in 2004.

Controversy

Modifying fish to make them more attractive as pets is an increasingly divisive issue. Historically, artificially dyeing fish was fairly common, with glassfish for example being injected with fluorescent dyes. The major British fishkeeping magazine, Practical Fishkeeping, has been effective in its campaign to remove these fish from the market by educating retailers and aquarists to the cruelty and health risks involved.

In 2006, Practical Fishkeeping published an article exposing the techniques for performing cosmetic surgery on aquarium fish, without anaesthetia, as described by Singaporean fishkeeping magazine *Fish Love Magazine*. The tail is cut off and dye is injected into the body to make the fish more valuable. The piece also included the first documented evidence to demonstrate that parrot cichlids are dyed through injections of coloured dye. Practical Fishkeeping also reported in 2006 that suppliers in Hong Kong were offering a service in which fish could be tattooed with company logos or messages using a dye laser. Such fishes have been sold in the UK under the name of Kaleidoscope gourami and Striped parrot cichlid.

Hybrid fish such as flowerhorn cichlids and parrot cichlids are highly controversial. Parrot cichlids in particular have a very unnatural shape that prevents them from swimming properly and makes it difficult for them to engage in their normal feeding and social behaviours. The biggest concern with hybrids is that they may be bred back with true species, making it difficult for hobbyists to identify and breed particular species. This is especially important where hobbyists are conserving species that are rare or extinct in the wild Even within a single species, extreme mutations have been selected for by some breeders; some of the fancy goldfish varieties in particular have been criticised for having features that prevent the fish from swimming, seeing, or feeding properly. Genetically modified fish like the glofish are likely to become increasingly available as well, particularly in the United States.

Invasive Species

Serious problems can occur when fish originally kept in ponds or aquaria are released into the wild. While tropical species of fish will not live for long in temperate zone climates, fish released into places with similar climatic conditions to those that they originally came from can survive and potentially form viable populations. Species that have established themselves in place that they are not native to are called exotic species. Examples of exotic fish that have become established outside their normal range are the Asian snakeheads in Hawaii, African walking catfish in Florida, and goldfish in Australia. Some of these exotic species can become extremely disruptive preying on, or competing with, the native fish.

Further reading

- *Aquarium Atlas, vol. 1*, by Hans A. Baensch and Rudiger Riehl ISBN 1890087122
- *Brackish Water Fishes*, by Frank Schäfer ISBN 393602782X
- *The Conscientious Marine Aquarist*, by Robert Fenner (2001) ISBN 1-890087-02-5
- *Chapman, F., Sharon A. Fitz-Coy, Eric M. Thunberg, and Charles M. Adams (March 1997). "United States of America Trade in Ornamental Fish". Journal of the World Aquaculture Society* ***28*** *(1): 1-10.*

See also

- Aquarium

Home | Aquaria | Barbs | Carp | Catfishes | Characidae | Cichlidae | Corydoras | Danios | Gobiidae | Goldfish | Osphronemidae | Poecilia | Siluriformes | Tetras | Acanthemblemaria spinosa | Altolamprologus | Bala shark | Brine shrimp | Bubble nest | Daphnia | Deep sand bed | Fish anatomy | Fish diseases | Gobiosoma multifasciatum | Ichthyology terms | List of freshwater aquarium fish species | List of freshwater aquarium invertebrate species | List of freshwater aquarium plant species | List of marine aquarium fish species | Live rock | Marine aquarium | Painted fish | Protein skimmer | Reef aquarium | Saddleback clownfish

Aquaria

An **aquarium** (plural *aquariums* or *aquaria*) is a vivarium, usually contained in a clear-sided container (typically constructed of glass or high-strength plastic) in which water-dwelling plants and animals (usually fish, and sometimes invertebrates, as well as amphibians, marine mammals, and reptiles) are kept in captivity, often for public display; or it is an establishment featuring such displays. Aquarium keeping is a popular hobby around the world, with about 60 million enthusiasts worldwide. From the 1850s, when the predecessor of the modern aquarium was first developed as a novelty, the ranks of aquarists have swelled as more sophisticated systems including lighting and filtration systems were developed to keep aquarium fish healthy. Public aquaria reproduce the home aquarist's hobby on a grand scale — the Osaka Aquarium, for example, boasts a tank of 5,400 m^3 (1.4 million U.S. gallons) and a collection of about 580 species of aquatic life, whilst the planned National institute for research into aquatic habitats in England would be at 40-hectares the world's largest aquarium.

A wide variety of aquaria are now kept by hobbyists, ranging from a simple bowl housing a single fish to complex simulated ecosystems with carefully engineered support systems. Aquaria are usually classified as containing fresh water or salt water and brackish water, at tropical or cold water temperatures. These characteristics, and others, determine the type of fish and other inhabitants that can survive and thrive in the aquarium. Inhabitants for aquaria are often collected from the wild, although there is a growing list of organisms that are bred in captivity for supply to the aquarium trade.

The careful aquarist dedicates considerable effort to maintaining a tank ecology that mimics its inhabitants' natural habitat. Controlling water quality includes managing the inflow and outflow of nutrients, most notably the management of waste produced by tank inhabitants. The nitrogen cycle describes the flow of nitrogen from input via food, through toxic nitrogenous waste produced by tank inhabitants, to metabolism to less toxic compounds by beneficial bacteria populations. Other components in maintaining a suitable aquarium environment include appropriate species selection, management of biological loading, and good physical design. Failing to provide these conditions may invite Fish diseases.

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History and development

Etymology

The word aquarium itself is taken directly from the latin *aqua*, meaning water, with the suffix *-rium*, meaning "place" or "building".

Ancient practices

The keeping of fish in confined or artificial environments is a practice with deep roots in history. Ancient Sumerians were known to keep wild-caught fish in ponds, before preparing them for meals. In China, selective breeding of carp into today's popular koi and goldfish is believed to have begun over 2,000 years ago. Depictions of the sacred fish of Oxyrhynchus kept in captivity in rectangular temple pools have been found in ancient Egyptian art. Many other cultures also have a history of keeping fish for both functional and decorative purposes. The Chinese brought goldfish indoors during the Song dynasty to enjoy them in large ceramic vessels.

Glass enclosures

The concept of an aquarium, designed for the observation of fish in an enclosed, transparent tank to be kept indoors, emerged more recently. However, it is difficult to pinpoint the exact date of this development. In 1665 the diarist Samuel Pepys recorded seeing in London "a fine rarity, of fishes kept in a glass of water, that will live so forever, and finely marked they are, being foreign." The fish observed by Pepys were likely to have been the paradise fish, Macropodus opercularis, a familiar garden fish in Guangzhou (Canton), China, where the East India Company was then trading. In the 18th century, the biologist Abraham Trembley kept hydra found in the garden canals of the Bentinck residence 'Sorgvliet' in the Netherlands, in large cylindrical glass vessels for study. The concept of keeping aquatic life in glass containers, then, dates to at latest this period.

Popularization

The keeping of fish in an aquarium first became a popular hobby in Britain only after ornate aquaria in cast-iron frames were featured at the Great Exhibition of 1851. The framed-glass aquarium was a specialized version of the glazed Wardian case developed for British horticulturists in the 1830s to protect exotic plants on long sea voyages. (One feature of some 19th century aquaria that would prove curious to hobbyists today was the use of a metal base panel so that the aquarium water could be heated by flame.) Germans rivaled the British in their interest, and by the turn of the century Hamburg became the European port of entry for many newly seen species. Aquaria became more widely popular as houses became almost universally electrified after World War I. With electricity great improvements were made in aquarium technology, allowing artificial lighting as well as the aeration, filtration, and heating of the water. Popularization was also assisted by the availability of air freight, which allowed a much wider variety of fish to be successfully imported from distant regions of origin that consequently attracted new hobbyists.

There are currently estimated to be about 60 million aquarium hobbyists worldwide, and many more aquaria kept by them. The hobby has the strongest following in Europe, Asia, and North America. In the United States, a large minority (40%) of aquarists maintain two or more tanks at any one time.

Function and design

From the outdoor ponds and glass jars of antiquity, modern aquaria have evolved into a wide range of specialized systems. Aquaria can vary in size from a small bowl large enough for a single small fish, to the huge public aquaria that can simulate entire marine ecosystems. The most successful aquaria, as judged by the long-term survivability of its inhabitants, carefully emulate the natural environments that their residents would occupy in the wild.

Freshwater aquaria remain the most popular due to their lower cost and easier maintenance, but marine (saltwater) aquaria have gained cachet as dedicated enthusiasts prove it is possible to preserve these challenging environments.

Design

The common freshwater aquarium maintained by a home aquarist typically includes a filtration system, an artificial lighting system, air pumps, and a heater. In addition, some freshwater tanks (and most saltwater tanks) use powerheads to increase water circulation.

Combined biological and mechanical filtration systems are now common; these are designed to remove potentially dangerous build up of nitrogenous wastes and phosphates dissolved in the water, as well as particulate matter. Filtration systems are the most complexly engineered component of most home aquaria, and various designs are used. Most systems use pumps to remove a small portion of the tank's water to an external pathway where filtration occurs; the filtered water is then returned to the aquarium. Protein skimmers, filtration devices that remove proteins and other waste from the water, not only work in Marine aqauriums but also work in nutrient rich environments, but are made popular through the use of the Berlin System.

Air pumps are employed to adequately oxygenate (or in the case of a heavily planted aquarium, provide carbon dioxide to) the water. These devices, once universal, are now somewhat less commonly used as some newer filtration systems create enough surface agitation to supply adequate gas exchange at the surface. Aquarium heaters are designed to act as thermostats to regulate water temperature at a level designated by the aquarist when the prevailing temperature of air surrounding the aquarium is below the desired water temperature. Coolers are also available for use in cold water aquaria or in parts of the world where the ambient room temperature is above the desired tank temperature.

An aquarium's physical characteristics form another aspect of aquarium design. Size, lighting conditions, density of floating and rooted plants, placement of bogwood, creation of caves or overhangs, type of substrate, and other factors (including an aquarium's positioning within a room) can all affect the behavior and survivability of tank inhabitants.

The combined function of these elements is to maintain appropriate water quality and characteristics suitable for the aquarium's residents.

Classifications

Aquaria can be classified by several variables that determine the type of aquatic life that can be suitably housed. The conditions and characteristics of the water contained in an aquarium are the most important classification criteria, as most aquatic life will not survive even limited exposure to unsuitable water conditions. The size of an aquarium also limits the aquarist in what types of ecosystems he can reproduce, species selection, and biological loading.

Water conditions

The solute content of water is perhaps the most important aspect of water conditions, as total dissolved solids and other constituents can dramatically impact basic water chemistry, and therefore how organisms are able to interact with their environment. Salt content, or salinity, is the most basic classification of water conditions. An aquarium may have fresh water (a salt level of < 0.5 PPT), simulating a lake or river environment; brackish water (a salt level of 0.5 to 30 PPT), simulating environments lying between fresh and salt, such as estuaries; and salt water or sea water (a salt level of 30 to 40 PPT), simulating an ocean or sea environment. Rarely, even higher salt concentrations are maintained in specialized tanks for raising brine organisms.

Several other water characteristics result from dissolved contents of the water, and are important to the proper simulation of natural environments. The pH of the water is a measure of the degree to which it is alkaline or acidic. Saltwater is typically alkaline, while the pH of fresh water varies more. Hardness measures overall dissolved mineral content; hard or soft water may be preferred. Dissolved organic content and dissolved gases content are also important factors.

Home aquarists typically use modified tap water supplied through their local water supply network to fill their tanks. For freshwater aquaria, additives formulated to remove chlorine or chloramine (used to disinfect drinking water supplies for human consumption) are often all that is needed to make the water ready for aquarium use.

Brackish or saltwater aquaria require the addition of a mixture of salts and other minerals, which are commercially available for this purpose.

More sophisticated aquarists may make other modifications to their base water source to modify the water's alkalinity, hardness, or dissolved content of organics and gases, before adding it to their aquaria. There are two processes used for that: deionization or reverse osmosis. In contrast, public aquaria with large water needs often locate themselves near a natural water source (such as a river, lake, or ocean) in order to have easy access to a large volume of water that does not require much further treatment.

Secondary water characteristics

Secondary water characteristics are also important to the success of an aquarium. The temperature of the water forms the basis of one of the two most basic aquarium classifications: tropical vs. cold water. Most fish and plant species tolerate only a limited range of water temperatures: Tropical or warm water aquaria, with an average temperature of about 25 °C (77 °F), are much more common, and tropical fish are among the most popular aquarium denizens. Cold water aquaria are those with temperatures below what would be considered tropical; a variety of fish are better suited to this cooler environment.

Water movement can also be important in accurately simulating a natural ecosystem. Aquarists may prefer anything from still water up to swift simulated currents in an aquarium, depending on the conditions best suited for the aquarium's inhabitants.

Water temperature can be regulated with a combined thermometer/heater unit (or, more rarely, with a cooling unit), while water movement can be controlled through the use of powerheads and careful design of internal water flow (such as location of filtration system points of inflow and outflow).

Size

An aquarium can range from a small, unadorned glass bowl containing less than a litre of water – although generally unsuited for most fish - to immense tanks built in public aquaria which are limited only by engineering constraints and can house entire ecosystems as large as kelp forests or species of large sharks. In general, larger aquarium systems are typically recommended to hobbyists due to their resistance to rapid fluctuations of temperature and pH, allowing for greater system stability.

Aquaria kept in homes by hobbyists can be as small as 3 U.S. gallons (11 L). This size is widely considered the smallest practical system with filtration and other basic systems; indeed, the local government of Rome, Italy, has recently taken the step of banning traditional goldfish bowls as inhumane. Practical limitations, most notably the weight (fresh water weighs about 8.3 pounds per U.S. gallon (1 kg/L), and salt water is even denser) and internal water pressure (requiring thick, strong glass siding) of a large aquarium, keep most home aquaria to a maximum of around 1 m^3 (300 U.S. gallons). However, some dedicated aquarists have been known to construct custom aquaria of up to several thousand U.S. gallons (several cubic meters), at great effort and expense.

Public aquaria designed for exhibition of large species or environments can be dramatically larger than any home aquarium. The Shedd Aquarium features an individual aquarium of two million U.S. gallons (19,000 m^3), as well as two others of 400,000 U.S. gallons (1,500 m^3). The Monterey Bay Aquarium has an acrylic viewing window into their largest tank. At 56 feet long by 17 feet high (17 by 5 m), it used to be the largest window in the world and is over 13 inches (330 mm) thick. The Okinawa Churaumi Aquarium is the world's second largest aquarium and part of the Ocean Expo Park (see Expo '75) located in Motobu, Okinawa. Its main tank, which holds 7,500 cubic meters of water, features the world's largest acrylic panel measuring 8.2 meters by 22.5 meters with a thickness of 60 centimeters. The size of public aquaria are usually limited by cost considerations.

Species selection

Several theories on species selection circulate within the community of hobby aquarists. Perhaps the most popular of these is the division of aquaria into either a *community* or *aggressive* tank type. Community tanks house several species that are not aggressive toward each other. This is the most common type of hobby aquarium kept today. Aggressive tanks, in contrast, house a limited number of species that can be aggressive toward other fish, or are able to withstand aggression well. In both of these tank types, the aquarium cohabitants may or may not originate from the same geographic region, but generally tolerate similar water conditions. In addition to the fish, invertebrates, aquatic plants, and decorations or "aquarium furniture" (all of which may or may not be natural neighbors of any of the fish) are typically added to these tank types.

Species or *specimen* tanks usually only house one fish species, along with plants, perhaps found in the fishes' natural environment and decorations simulating a true ecosystem. These tanks are often used for killifish, livebearers, cichlids etc. They can be simple as bare bottom with a few necessities or a complex planted aquarium. Some tanks of this sort are used simply to house adults for breeding. Such tanks are common in fishrooms, where people keep many tanks at home.

Ecotype or *ecotope* aquaria attempt to simulate a specific ecosystem found in the natural world, bringing together fish, invertebrate species, and plants found in that ecosystem in a tank with water conditions and decorations designed to simulate their natural environment. These ecotype aquaria might be considered the most sophisticated hobby aquaria; indeed, reputable public aquaria all use this approach in their exhibits whenever possible. This approach best simulates the experience of observing an aquarium's inhabitants in the wild, and also usually serves as the healthiest possible artificial environment for the tank's occupants.

Species selection for saltwater aquaria

In addition to the types above, a special category of saltwater aquaria is the reef aquarium. These aquaria attempt to simulate the complex reef ecosystems found in warm, tropical oceans around the world. These aquaria focus on the rich diversity of invertebrate life in these environments, and typically include only a limited number of small fish. Techniques of maintaining sea anemones, some corals, live rock, mollusks, and crustaceans, developed since the 1980s, have made the recreations of a reef ecosystem possible. Reef aquaria are widely considered the most difficult and demanding of the common hobbyist aquarium types, requiring the most expertise in addition to the most specialized equipment (and corresponding high cost).

Source of aquarium inhabitants

Fish and plants for the first modern aquaria were gathered from the wild and transported (usually by ship) to European and American ports. During the early 20th century many species of small colorful tropical fish were caught and exported from Manaus, Brazil; Bangkok, Thailand; Jakarta, Indonesia; the Netherlands Antilles; Kolkata, India; and other tropical ports. Collection of fish, plants, and invertebrates from the wild for supply to the aquarium trade continues today at locations around the world. In many places of the world, impoverished local villagers collect specimens for the aquarium trade as their prime means of income. It remains an important source for many species that have not been successfully bred in captivity, and continues to introduce new species to enthusiastic aquarists.

The practice of collection in the wild for eventual display in aquaria has several disadvantages. Collecting expeditions can be lengthy and costly, and are not always successful. The shipping process is very hazardous for the fish involved; mortality rates are high. Many others are weakened by stress and become diseased upon arrival. Fish can also be injured during the collection process itself, most notably during the process of using cyanide to stun reef fish to make them easier to collect.

More recently, the potentially detrimental environmental impact of fish and plant collecting has come to the attention of aquarists worldwide. These include the poisoning of coral reefs and non-target species, the depletion of rare species from their natural habitat, and the degradation of ecosystems from large scale removal of key species. Additionally, the destructive fishing techniques used have become a growing concern to environmentalists and hobbyists alike. Therefore, there has been a concerted movement by many concerned aquarists to reduce the trade's dependence on wild-collected specimens through captive breeding programs and certification programs for wild-caught fish. Among American keepers of marine aquaria surveyed in 1997, two thirds said that they prefer to purchase farm raised coral instead of wild-collected coral, and over 80% think that only sustainably caught or captive bred fish should be allowed for trade.

Since the Siamese Fighting Fish (Betta splendens) was first successfully bred in France in 1893, captive spawning techniques have been slowly discovered. Captive breeding for the aquarium trade is now concentrated in southern Florida, Singapore, Hong Kong, and Bangkok, with smaller industries in Hawaii and Sri Lanka. Captive breeding programs of marine organisms for the aquarium trade have been urgently in development since the mid-1990s. Breeding programs for freshwater species are comparatively more advanced than for saltwater species.

Aquaculture is the cultivation of aquatic organisms in a controlled environment. Supporters of aquaculture programs for supply to the aquarium trade claim that well-planned programs can bring benefits to the environment as well as the society around it. Aquaculture can help in lessening the impacts on wild stocks, either by using raised cultivated organisms directly for sale or by releasing them to replenish wild stock, although such a practice is associated with several environmental risks.

A downside of the aquarium fish trade has been its role as a source of invasive fish and aquatic plant species. Exotic fish and aquatic plant species have been established in countries outside of their origin by irresponsible tank owners releasing their exotic fish or emptying their tank contents into rivers and streams, which in some cases have posed a threat to native species and ecosystems.

Ecology

Ideal aquarium ecology reproduces the balance found in nature in the closed system of an aquarium. In practice it is virtually impossible to maintain a perfect balance. As an example, a balanced predator-prey relationship is nearly impossible to maintain in even the largest of aquaria. Typically an aquarium keeper must take steps to maintain balance in the small ecosystem contained in his aquarium.

Approximate balance is facilitated by large volumes of water. Any event that perturbs the system pushes an aquarium away from equilibrium; the more water that is contained in a tank, the easier such a systemic shock is to absorb, as the effects of that event are diluted. For example, the death of the only fish in a three U.S. gallon tank (11 L) causes dramatic changes in the system, while the death of that same fish in a 100 U.S. gallon (400 L) tank with many other fish in it represents only a minor change in the balance of the tank. For this reason, hobbyists often favor larger tanks when possible, as they are more stable systems requiring less intensive attention to the maintenance of equilibrium.

Nitrogen cycle

The nitrogen cycle in an aquarium.

Of primary concern to the aquarist is management of the biological waste produced by an aquarium's inhabitants. Fish, invertebrates, fungi, and some bacteria excrete nitrogen waste in the form of ammonia (which may convert to ammonium, depending on water chemistry) which must then pass through the nitrogen cycle. Ammonia is also produced through the decomposition of plant and animal matter, including fecal matter and other detritus. Nitrogen waste products become toxic to fish and other aquarium inhabitants at high concentrations.

A well-balanced tank contains organisms that are able to metabolize the waste products of other aquarium residents. The nitrogen waste produced in a tank is metabolized in aquaria by a type of bacteria known as nitrifiers (genus Nitrosomonas). Nitrifying bacteria capture ammonia from the water and metabolize it to produce nitrite. Nitrite is also highly toxic to fish in high concentrations. Another type of bacteria, genus Nitrospira, converts nitrite into nitrate, a less toxic substance to aquarium inhabitants. (Nitrobacter bacteria were previously believed to fill this role, and continue to be found in commercially available products sold as kits to "jump start" the nitrogen cycle in an aquarium. While biologically they could theoretically fill the same niche as Nitrospira, it has recently been found that Nitrobacter are not present in detectable levels in established aquaria, while Nitrospira are plentiful.) This process is known in the aquarium hobby as the nitrogen cycle.

In addition to bacteria, aquatic plants also eliminate nitrogen waste by metabolizing ammonia and nitrate. When plants metabolize nitrogen compounds, they remove nitrogen from the water by using it to build biomass. However, this is only temporary, as the plants release nitrogen back into the water when older leaves die off and decompose.

Although informally called the nitrogen cycle by hobbyists, it is in fact only a portion of a true cycle: nitrogen must be added to the system (usually through food provided to the tank inhabitants), and nitrates accumulate in the water at the end of the process, or become bound in the biomass of plants. This accumulation of nitrates in home aquaria requires the aquarium keeper to remove water that is high in nitrates, or remove plants which have grown from the nitrates.

Aquaria kept by hobbyists often do not have the requisite populations of bacteria needed to detoxify nitrogen waste from tank inhabitants. This problem is most often addressed through two filtration solutions: Activated carbon filters absorb nitrogen compounds and other toxins from the water, while biological filters provide a medium specially designed for colonization by the desired nitrifying bacteria.

New aquariums often have problems associated with the nitrogen cycle due to insufficient number of beneficial bacteria. Therefore new tanks have to be "matured" before stocking them with fish. There are two basic approaches to this: the *fishless cycle* and the *silent cycle*.

No fish are kept in a tank undergoing a fishless cycle. Instead, small amounts of ammonia are added to the tank to feed the bacteria being cultured. During this process, ammonia, nitrite, and nitrate levels are tested to monitor progress. The silent cycle is basically nothing more than densely stocking the aquarium with fast-growing aquatic plants and relying on them to consume the nitrogen, allowing the necessary bacterial populations time to develope. According to anecdotal reports of aquarists specializing in planted tanks, the plants can consume nitrogenous waste so efficiently that the spikes in ammonia and nitrite levels normally seen in more traditional cycling methods are greatly reduced, if they are detectable at all.

The largest bacterial populations in a tank are found in the filter. Therefore efficient filtration is vital. A vigorous cleaning of the filter is sometimes enough to seriously disturb the biological balance of an aquarium.

Other nutrient cycles

Nitrogen is not the only nutrient that cycles through an aquarium. Dissolved oxygen enters the system at the surface water-air interface or through the actions of an air pump. Carbon dioxide escapes the system into the air. The phosphate cycle is an important, although often overlooked, nutrient cycle. Sulfur, iron, and micronutrients also cycle through the system, entering as food and exiting as waste. Appropriate handling of the nitrogen cycle, along with supplying an adequately balanced food supply and considered biological loading, is usually enough to keep these other nutrient cycles in approximate equilibrium.

Biological loading

Biological loading is a measure of the burden placed on the aquarium ecosystem by its living inhabitants. High biological loading in an aquarium represents a more complicated tank ecology, which in turn means that equilibrium is easier to perturb. In addition, there are several fundamental constraints on biological loading based on the size of an aquarium. The surface area of water exposed to air limits dissolved oxygen intake by the tank. The capacity of nitrifying bacteria is limited by the physical space they have available to colonize. Physically, only a limited size and number of plants and animals can be fit into an aquarium while still providing room for movement.

In order to prevent biological overloading of the system, aquarists have developed a number of rules of thumb. Perhaps the most popular of these is the "7mm per liter of water" which dictates that the sum in cm of the lengths of all fish kept in an aquarium (excluding tail length) should not exceed the capacity of the tank measured in Liters (one inch of fish per U.S. gallon). This rule is usually applied to the expected mature size of the fish, in order to not stunt growth by overcrowding, which can be unhealthy for the fish. (Note that this rule of thumb breaks down for thick bodied fishes like some catfish, and aggressive fish like most Cichlids.) For goldfish and other high-waste fish, many aquarists recommend doubling the space allowance to one inch of fish per every two gallons and others even debate the usefulness of the "inch per gallon" rule because if fails to consider other important issues such as fish temperament, activity, compatibility with other tank mates(i.e. two male bettas shouldn't be kept together) dimensions of aquarium, and the filtration capabilities of the aquarium. The safest method of determining the stocking limits and compatibility is to talk to an experienced aquarist or group of aquarists at a local organization or a dedicated online forum.

The true maximum or ideal biological loading of a system is very difficult to calculate, even on a theoretical level. To do so, the variables for waste production rate, nitrification efficiency, gas exchange rate at the water surface, and many others would need to be determined. In practice this is a very complicated and difficult task, and so most aquarists use rules of thumb combined with a trial and error approach to reach an appropriate level of biological loading.

Public aquaria

Public aquaria are facilities open to the public for viewing of aquatic species in aquaria. Most public aquaria feature a number of smaller tanks, as well as one or more tanks greater in size than could be kept by any home aquarist. The largest tanks hold millions of U.S. gallons of water and can house large species, including dolphins, sharks or beluga whales. Aquatic and semiaquatic animals, including otters and penguins, may also be kept by public aquaria.

Operationally, a public aquarium is similar in many ways to a zoo or museum. A good aquarium will have special exhibits to entice repeat visitors, in addition to its permanent collection. A few have their own version of a "petting zoo"; for instance, the Monterey Bay Aquarium has a shallow tank filled with common types of rays, and one can reach in to feel their leathery skins as they pass by.

Also as with zoos, aquaria usually have specialized research staff who study the habits and biology of their specimens. In recent years, the large aquaria have been attempting to acquire and raise various species of open-ocean fish, and even jellyfish (or sea-jellies, cnidaria), a difficult task since these creatures have never before encountered solid surfaces like the walls of a tank, and do not have the instincts to turn aside from the walls instead of running into them.

The first public aquarium opened in London's Regent's Park in 1853. P.T. Barnum quickly followed with the first American aquarium, opened on Broadway in New York. Following early examples of Detroit, New York, Philadelphia and San Francisco, many major cities now have public aquaria.

Most public aquaria are located close to the ocean, for a steady supply of natural seawater. An inland pioneer was Chicago's Shedd Aquarium that received seawater shipped by rail in special tank cars. The early (1911) Philadelphia Aquarium, built in the city's disused water works, ironically had to switch to treated city water when the nearby river became too contaminated. Similarly, the recently opened Georgia Aquarium filled its tanks with fresh water from the city water system and salinated its salt water exhibits using the same commercial salt and mineral additives available to home aquarists.

In January 1985 Kelly Tarlton began construction of the first aquarium to include a large transparent acrylic tunnel in Auckland, New Zealand, a task that took 10 months and cost NZ$3 million. The 110-meter tunnel was built from one-tonne slabs of German sheet plastic that were shaped locally in an oven. A moving walkway now transports visitors through, and groups of school children occasionally hold sleepovers there beneath the swimming sharks and rays.

Top public aquaria are often affiliated with important oceanographic research institutions or conduct their own research programs, and usually (though not always) specialize in species and ecosystems that can be found in local waters.

See also

- Freshwater aquarium
  - List of freshwater aquarium fish species
  - List of freshwater aquarium plant species
  - List of freshwater aquarium invertebrate species
  - Community tank
- Marine aquarium
  - Reef aquarium
- Fishkeeping
- Marine mammal park

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Airstone

An **airstone** is a piece of aquarium furniture, traditionally a piece of limewood or porous stone, whose purpose is to gradually diffuse oxygen into the tank, eliminating the noise and large bubbles of conventional air filtration systems, and providing other benefits to the health of the fish. Airstones are sold in a very wide variety of shapess, sizes, and levels of coarseness--from extremely rough, producing larger (though still typically unnoticeable) bubbles and letting in more oxygen--to very fine, producing minuscule bubbles. Airstones are increasingly being made from bonded glass beads and synthetic products like fiberglass.

There is some controversy as to the efficiency of airstones versus the conventional powerhead system. Arguments can be made in favor of both systems, and both possess certain advantages and disadvantages. Among aquarists, the choice is very much a matter of personal preference, although the question is sometimes a shibboleth in Internet discussions.

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Alternanthera

There are only a few aquatic plants of species *Alternanthera* suitable for aquarium use. They are considered difficult to grow and maintain, because they are sensitive to certain parameters of light, water, and fertilizers.

Available species

- *Alternanthera bettzichiana*
- *Alternanthera reineckii*
    - *Alternanthera reineckii* var. *lilacina*
    - *Alternanthera reineckii* var. *roseafolia*
    - *Alternanthera reineckii* var. *rubra*
- *Alternanthera sessilis (semi-aquatic)*

See also

- List of freshwater aquarium plant species

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Aquarium furniture

Aquarium furniture refers to the various ornaments and functional items in an aquarium.

Ornamental aquarium furniture is often kitsch: popular examples include ceramic mermaids, 'sunken' ships and castles, and the ever-popular (but curiously misplaced) "No Fishing" sign. Another strange piece of decor is the ubiquitous plastic corals found often in freshwater tanks.

Examples of functional aquarium furniture would include devices for removing algae from the glass (either a razor or a scouring pad, attached to the glass by a magnet), airstones, water filters, water heaters, and food dispensers.

Aquarium furniture may also refer to an item of (regular) furniture that features an aquarium in its design. A stand or cabinet that supports the aquarium may be considered aquarium furniture. Also, many home reef aquariums canopies containing metal halide lights. The canopies are often constructed to the same standards as high quality cabinetry

See also

Live rock

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Aquascaping

Aquascaping is a Art Form enjoyed by aquarium enthusiasts around the world. It entails arranging aquatic plants in an aesthetically-pleasing manner within an aquarium.

Quite possibly the most influential Aquarist is Takashi Amano, who introduced the Japanese-style of aquarium design to the world and sparked a wave of interest in aquarium gardening. Takashi Amano's compositions draw on Japanese gardening techniques that attempt to mimic nature by way of the asymmetrical arrangement of constituent elements. Another popular style is the "Dutch tank", which consists of a more orderly, and hence, more unnatural style.

Aquascaping also commonly refers to the arrangement of rocks and cavework within the tank. This often occurs specifically in regard to marine fish and cichlids.

Although an aquascaping artist's primary aim is to artfully create an underwater landscape, he or she is also necessarily concerned with the technical aspects of aquatic plant maintenance. Filtration, carbon dioxide supply, fertilization, lighting and algae control [1]are among the many factors that must be balanced in the closed system of an aquarium tank to ensure the success of an aquascape.

There are many organizations and groups in existence that support the aquascaping community. One such group, based in the U.S., is the Aquatic Gardener's Association, which holds an annual aquascaping competition that draws entries from all over the world.

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Community tank

Community tanks are aquaria that are designed to contain more than one species of fish. Most commonly they include a variety species that do not normally occur together in nature, for example angelfish from Brazil, swordtails from Mexico, and gouramis from South East Asia. The aim of such communities is to bring together fish that are compatible in temperament and water requirements, while using their different colours and behaviours to add interest and entertainment value.

Though not usually called community tanks, most marine aquaria fit into this category too, using fish from places as diverse as the Caribbean, Red Sea, and western Pacific Ocean.

Other aquarists prefer communities that represent particular locations, and combine fishes from a certain place with appropriate decorative materials including the right kinds of rocks and plants. The most popular of these geographically correct community tanks are those based around cichlids from the East African Rift Valley lakes of Lake Tanganyika and Lake Malawi.

Good community fish

For freshwater community tanks, there are large numbers of species that work well. Most of the livebearers, barbs, tetras, rasboras, danios, and rainbowfish are peaceful, though a few species are fin nippers, most notably tiger barbs and serpae tetras. Angelfish, gouramis, and dwarf catfish (Corydoras) can also work well, though angelfish at least are predatory and will eat very small fish such as neon tetras.

Notoriously bad community fish include the red-tailed black shark, the sucking loach *Gyrinocheilus aymonieri*, and many types of cichlid and catfish. These fish are often aggressive and/or predatory, so are best kept in species tanks or in carefully constructed communities with other robust species.

Water chemistry

Most freshwater aquarium fish do well in water that is soft to moderately hard, and has a pH between 6 and 8; the notable exceptions are the Poeciliidae such as guppies and mollies, which should generally only be kept in hard, alkaline water.

Brackish water aquaria are another special case and need their own community tanks. While a few freshwater and marine fish can adapt to brackish water, most cannot

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Dolphinarium

A **dolphinarium** is an aquarium for dolphins. The dolphins are usually kept in a large pool, though occasionally they may be kept in pens in the open sea, either for research or for public performances. Some dolphinariums consist of one pool where dolphins perform for the public, others have expanded into much larger parks, keeping other marine animals and having other attractions. These larger parks are often not considered to be dolphinariums themselves, but marine mammal parks or theme parks that include a dolphinarium. A dolphinarium can also be part of a zoo.

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- 1 History
- 2 Design
- 3 Species
    - 3.1 Trade and capture
- 4 Animal welfare
- 5 See also
- 6 References

History

Though cetaceans have been held in captivity in both North America and Europe since the 1860's, the first being a pair of Beluga Whales in the New York museum, dolphins were first kept for paid entertainment in the Marine Studios dolphinarium founded in 1938 in St. Augustine, Florida. It was here that it was discovered that dolphins could be trained to perform tricks. Recognizing the success of Marine Studios, more dolphinariums keeping dolphins for entertainment followed.[1] In the 1960's, keeping dolphins in captivity for entertainment purposes became increased in popularity after the 1963 Flipper movie and subsequent Flipper television series. In 1966, the first dolphin was exported to Europe. In these early days, dolphinariums could grow quickly due to a lack of legislation and lack of concern for animal welfare. New legislation, most notably the 1972 Marine Mammal Protection Act in the United States, combined with a more critical view on animal welfare forced many dolphinariums around the world to close. As an example, during the early 1970's there were at least 36 dolphinariums and travelling dolphin shows in the United Kingdom, none of which still exist today, the last dolphinarium in the UK having closed its doors in 1993.[2]

Design

A common dolphinarium design for public performances consists of stands for the public around a semi-circular pool, sometimes with glass walls which allow underwater viewing, and a platform in the middle from which the trainers direct and present the show.

The water in the pools has to be constantly filtered to keep it clean for the spectators and the dolphins, and the temperature and composition of the water has to be controlled to match the conditions dolphins experience in the wild. To give an indication of pool sizes, the *European Association for Aquatic Mammals* recommends that a pool for five dolphins should have a surface area of 275 m^2 (2960 ft^2) plus an additional 75 m^2 (810 ft^2) for every additional animal, have a depth of 3.5 m (11.5 ft) for at least the minimum surface area and have a water volume of at least 1000 m^3 (35300 ft^3) with an additional 200 m^3 (7060 ft^3) for every additional animal. If two of these three conditions are met and the third is not more than 10% below standard, the EAAM considers the pool size to be acceptable.[3]

Species

Various species of dolphins are kept in captivity and also several other small whale species such as Harbour Porpoises and Belugas, though in those cases the word dolphinarium may not be fitting as these are not true dolphins. Bottlenose Dolphins are the most common species of dolphin kept in dolphinariums: they are relatively easy to train, have a long lifespan in captivity and a friendly appearance. Hundreds if not thousands of Bottlenose Dolphins live in captivity across the world, though exact numbers are hard to give. Orcas are well known for their performances in shows, but the number of Orcas kept in captivity is very small especially when compared to the number of bottlenose dolphins, with only 46 captive Orcas being known as of 2006.[4] Of all Orcas kept in captivity, the majority are located in one of the SeaWorld parks in the United States. Some other species kept in captivity are Spotted Dolphins, False Killer Whales and Common Dolphins, but all in much lower numbers than the Bottlenose Dolphin. Two unusual and very rare hybrid dolphins known as Wolphins are kept at the Sea Life Park in Hawaii, which are a cross between a Bottlenose Dolphin and a False Killer Whale.

Trade and capture

In the early days, most Bottlenose Dolphins were wild caught off the coast of Florida where they are common, but the 1972 Marine Mammal Protection Act put an end to this. In most Western countries, few new dolphins are wild caught and breeding programmes have been set up to provide the dolphinariums with new animals. To achieve a sufficient birth rate and to prevent inbreeding, artificial insemination (AI) is occasionally used. The use of AI also allows dolphinariums to increase the genetic diversity of their population without having to bring in any dolphins from other locations, which is a complex operation and very stressful for the animal.

Live dolphins are still traded however. A live Bottlenose Dolphin is estimated to cost between a few thousand and several tens of thousands of US dollars, depending on age, condition and prior training. The trade of dolphins is regulated by CITES. Cuba is a major exporter of dolphins, this being organised by the Acuario Nacional de Cuba.[5] In recent years, the Solomon Islands have also allowed the capture and export of wild dolphins for the entertainment industry[6], however a 2005 law has now banned the export of dolphins.[7] Some, mainly Japanese, dolphinariums obtain their dolphins from local drive hunts.

Animal welfare

Though animal welfare has improved significantly over the last few decades, many animal rights and welfare groups such as the WSPA still consider keeping dolphins at dolphinariums a form of animal abuse. The main arguments are that dolphins do not have enough freedom of movement in pools regardless of pool size and do not get enough stimulation. Dolphins often show repetitive behavior in captivity and sometimes become aggressive towards other animals or people, having resulted in a number of fatalities amongst animals and also people, with at least one trainer having been killed. In some cases, the behaviour of dolphins in captivity also results in their own death.[8]

The lifespan of dolphins in captivity is an other subject of debate and research has shown that Orcas indeed have a much lower survival rate in captivity, however, for Bottlenose Dolphins no significant difference between survival rates can be found.[9]

In response to criticism, dolphinariums often stress that every effort is being made to ensure the well being of the animals.[10] Many dolphinariums are also involved in research projects, help out in case of beachings, provide aid to sick or injured wild animals and have educational programmes. Dolphin-assisted therapy (DAT), also known as dolphin human therapy (DHT), which is offered at many dolphinariums world wide, is considered to benefit people, especially children, with various psychological and neurological problems such as autism, depression, Down syndrome and various development problems.[11]

See also

- Marine mammal park

References

- Iridescent-publishing.com - The rose-tinted menagery, a history of keeping animals for entertainment, chapters four to six.

1. ^ "Following P.T. Barnum's ill-fated display of white whales in his New York Museum in 1860, it was not until 1913 that cetaceans were again seen in captivity, this time when C. H. Townsend, curator of the New York Aquarium, stumbled upon the idea exhibiting dolphins as an unbeatable novelty to attract the crowds.", "During feeding time at Marine Studios, it is said, dolphins gradually fell into the habit of jumping up to catch the fish that were thrown to them, and this miniature spectacle always amused the public, the keepers and curator. Then a year later in 1939, Cecil M. Walker, then responsible for maintenance of the water purification pumps on the night-shift, observed one evening how a dolphin pushed a pelican feather across the surface of the water towards him. "Just for the hell of it" he took the proffered feather and threw it back into the water, whereupon, to his great surprise, the dolphin brought it back again. The game continued with Walker experimenting with a ball, an inner tube of a bicycle, small stones and other objects. As the game took shape with other dolphins joining in the act, it began to resemble the repertoire seen today in every dolphinarium in the world.", quotes from *The rose-tinted menagery*.
2. ^ "In the golden heyday of the industry, there were at least 36 assorted dolphinaria or itinerant dolphin shows in the U.K.", quote from *The rose-tinted menagery*
3. ^ Recommended EAAM dolphin housing standards.
4. ^ Orcas in Captivity - A look at killer whales in aquariums and parks (when viewed 10 October 2006)
5. ^ "But it is in Fidel Castro's revolutionary Cuba that dolphin catching in South America has been given a new lease of life, under the auspices of the quasi state-run enterprise Acuario Nacional.", quote from *The rose-tinted menagery*
6. ^ HONIARA, Solomon Islands (Reuters) - A cargo plane arrived in the lawless Solomon Islands Monday to pick up wild dolphins captured to order for a Mexican syndicate in what activists have blasted as an environmental crime, regional media reported. [1]
7. ^ Solomon Islands law banning the export of dolphins
8. ^ Dolphin aggresion in captivity, listing a large number of incidents in dolphinariums that resulted in injury to either dolphins or trainers, including self-inflicted trauma. There is

mention of one fatal incident involving a trainer.

9. ^ Survival rate study of marine mammals in captivity
10. ^ "The biologists of Xcaret Park and veterinarians meet all the needs of these amazing dolphins. They monitor their health, weight, food, and in some facilities they conduct research on their behavior to present their findings at international conferences. Here, dolphins are treated with care and respect; their well being is always the main priority. In fact, biologists claim that the life expectancy of a dolphin, which is about 40 years, increases when they are placed in captivity or semi-captivity (in extensive areas of their natural habitat). As proof of this, dolphins have actually been born in one of these aquariums.", quote from: [2]
11. ^ "Animal facilitated therapy with dolphins is more effective than "water" therapy in treating people with mild to moderate depression after the influence of the natural setting has been controlled for, as shown by our randomised, single blind, controlled trial. The animal care programme improved the depressive symptoms of the participants significantly more than the outdoor nature programme. The natural setting itself is also an important factor that has to be considered in the treatment of emotional disorders. This is confirmed by other studies. The effects exerted by the animals were significantly greater than those of just the natural setting.", quote from Randomised controlled trial of animal facilitated therapy with dolphins in the treatment of depression, a paper by Christian Antonioli, PhD candidate in psychiatry and Michael A Reveley, professor of psychiatry.Home | Up

Marine mammal park

The orca "Shamu" performing at SeaWorld San Diego

A **marine mammal park** (sometimes *oceanarium*) is a commercial theme park or aquarium where marine mammals such as dolphins, beluga whales and sea lions are kept within water tanks and displayed to the public in special shows. A marine mammal park is more elaborate than a dolphinarium, because it also features other marine mammals and offers additional entertainment attractions. It is thus seen as a combination of a public aquarium and an amusement park. Marine mammal parks are different from marine parks, which include natural reserves and marine wildlife sanctuaries such as coral reefs, particularly in Australia.

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- 1 History
- 2 Criticism and animal welfare
- 3 Books
- 4 See also

History

The first marine mammal park, then called an oceanarium, was established in St. Augustine, Florida in 1938. It was initially a large water tank used to exhibit marine mammals for filming underwater movies, and only became later a public attraction. Today Marineland of Florida claims to be "the world’s first oceanarium".

The first park keeping orcas in captivity was Sea World at San Diego in the 1960s, soon followed by Marineland of the Pacific on the Palos Verdes Peninsula, in California, which closed down in 1986.

Between the 1970s and the 1990s, technical advances and the public's increasing interest in aquatic environments prompted a shift to large marine mammal parks with cetaceans (mostly orcas and other species of dolphin) as attractions. Within this time Sea World USA evolved as the most prominent chain of marine mammal parks, with operations in Orlando, Florida, San Diego, California, San Antonio, Texas, and Cleveland, Ohio (which has since closed down).

Criticism and animal welfare

Many animal welfare groups, such as the WSPA, consider keeping whales and dolphins in captivity a form of abuse. The main argument is that whales and dolphins do not have enough freedom of movement within their artificial environments. The existence of marine mammal parks is thus very controversially discussed.

Although sizable pools for whales and dolphins require an extraordinarily technical and financial expenditure and are usually nearly impossible to provide and maintain, many marine mammal parks endeavour to improve the conditions of captivity and attempt to engage in public education as well as scientific studies. For that purpose many marine mammal parks joined together in the "Alliance of Marine Mammal Parks and Aquariums", an international association dedicated to high standard of care of marine mammals. It was founded in 1987 and established offices near Washington, DC, in 1992.

Books

- Lou Jacobs, *Wonders of an oceanarium: The story of marine life in captivity*. Golden Gate Junior Books, 1965.
- Joanne F. Oppenheim, *Oceanarium*. Bantam Books, 1994. ISBN 0-553-09520-X

See also

- Dolphinarium
- Aquarium

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Substrate

The **substrate** of an aquarium refers to the material used on the tank bottom. It can affect water chemistry, filtration, and the well-being of the aquarium's inhabitants, and is also an important part of the aquarium's aesthetic appeal. The appropriate substrate depends on the type of aquarium; the most important parameter is whether the aquarium contains fresh water or saltwater.

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- 1 Substrates for freshwater aquaria
    - 1.1 Freshwater aquaria with live plants
- 2 Substrates for saltwater aquaria
- 3 Substrates for specialty tanks
- 4 Biological filtration via substrate
- 5 References

Substrates for freshwater aquaria

For freshwater aquaria, gravel is the most common substrate. Gravel sold specifically for use in aquaria is chemically inert. It may be naturally colored or dyed, and may have a polymer seal to ensure it does not affect water chemistry.

Types of substrates for freshwater include the following:

- **Gravel.** Aquarium gravel can be as coarse as pea-sized or as fine as 1–2 mm. It is commonly composed of quartz or other lime-free minerals. [1][2]
- **Shell grit**, **crushed limestone, crushed marble or crushed coral** skeletons. Because calcium carbonate, the primary component of these substrates, increases water hardness and pH, it is used most often for particularly for hard water species, such as those for African rift lake cichlids or cichlids from Central America. Calcium carbonate substrates are poorly suited to aquaria housing most other freshwater aquarium fish, particularly river species, which are adapted to soft water. [2]
- **Peat**, or decomposed plant matter. Peat is used most commonly in soft water or blackwater river systems, such as those mimicking the Amazon River basin. In addition to being soft in texture and therefore suitable for demersal (bottom-dwelling) species such as Corydoras catfish, peat is reported to have a number of other beneficial functions in freshwater aquaria. It softens water by acting as an ion exchanger, it contains substances good for plants and for the reproductive health of fishes, and can even prevent algae growth and kill microorganisms. Peat often stains the water yellow or brown due to the leaching of tannins. [2]
- **Sand.** This is often recommended for use with certain species, such as the river stingrays of family Potamotrygonidae, which bury themselves in the fine substrate. However, these species can be successfully kept with coarser substrates as well.

In some aquaria, different substrates are used in different parts of the tank. For example, peat can be used in one corner, while gravel in another portion allows rooted plants. [2]

Freshwater aquaria with live plants

Planted tanks require a substrate that will remain loose enough for plant roots to penetrate it. The substrate should be chemically inert and free of sharp edges. Examples include sand and gravel; fine gravel (1–2 mm) is preferred by some aquarists because coarser substrates allow debris to settle within the gaps between grains, which is particularly difficult to clean in a planted aquarium. Sloping the substrate so it is most shallow in front accommodates larger plants with correspondingly larger root systems in the back. The substrate for plants should be at least 5 cm (2 in) deep. Often, a lower layer of richer substrate such as potting soil, peat, vermiculite, or certain types of clay are used as a source of iron and trace elements for plant roots.[3][2]

Substrates for saltwater aquaria

For saltwater aquaria, coral gravel and coral sand are most common. Composed primarily of calcium carbonate, coral skeletons have a buffering effect on the water's pH. They also contribute calcium, needed by some invertebrates, to the water.

In a reef aquarium, the substrate can be an important part of managing the water chemistry. Calcium carbonate substrates such as those made from coral or oolitic aragonite are commonly used; when these minerals, insoluble in water, are dissolved by acid secretions, they release calcium and strontium, both of which are important to invertebrates such as stony corals.

Coral sand is considered the best substrate for a reef aquarium. At a depth of about 2.5 cm (1 in), it allows anoxic zones to form and host anaerobic bacteria which in turn denitrify the water, that is, convert nitrate to nitrogen gas. Animals such as sleeper gobies and some invertebrates such as turbo snails are useful to stir the sand.

Aquaria with marine invertebrates often incorporate live rock, which can be considered part of the substrate. Made of calcium carbonate, it has the same effects on water chemistry as coral gravel and sand. It is riddled with small holes and cavities which allow anoxic zones to form.[4]

Substrates for specialty tanks

In **breeding tanks** for egg-scattering species, a layer of marbles is sometimes used as a substrate, allowing the eggs to fall into the gaps between the marbles where the parents cannot eat them.[5]

Quarantine tanks (sometimes called *hospital tanks*) often use no substrate at all. This assists in keeping the aquarium as clean as possible. [1]

Biological filtration via substrate

Beneficial bacteria colonize all aquarium surfaces that are exposed to aerated water. Because the numerous particles have a high surface area, substrates are often employed in biological filtration.

In an **undergravel filter**, substrate (most commonly gravel or crushed coral) is placed on top of a grate containing one or more uplift tubes. Water is pumped up the tubes using either an air pump or small water pump, forcing flow through the substrate and aerating the entire gravel bed. Beneficial bacteria colonize the gravel bed and provide biological filtration. Undergravel filters are most often used in small aquaria, although they can be used in larger systems.

Undergravel filters are not effective if the substrate bed is uneven or if very fine substrates such as sand or peat are used. In an uneven gravel bed, water will flow only through the thin portions of the bed, leaving the more heavily covered areas to become anoxic. Because of this, animals that dig, such as cichlids, are best kept in an aquarium using some other type of filtration.

Even without an undergravel filter, some nitrifying bacteria are present on the surface of the substrate.

References

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Tropical fish

Tropical fish include fish found in tropical environments around the world, including both fresh water and salt water species. Tropical fish are popular aquarium fish , due to their often bright coloration.

Tropical fish kept for home aquaria include the following:

- Wild-caught specimens.
- Single-species individuals born in captivity. The latter category includes lines selectively bred for special physical features, such as long fins, or particular colorations, such as albino.
- Hybrids of more than one species.

Recreational SCUBA divers are often enthusiasts of tropical fish as well. Some keep lists of fish species they have observed while diving, especially in tropical marine environments.

See also

- Aquarium
- Fishkeeping
- List of freshwater aquarium fish species
- List of marine aquarium fish species

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Wet dry filter

A **wet/dry filter** (also known as a trickle filter) is one of the more efficient water filtration systems for marine and freshwater aquariums.

There are various setups that can be incorporated with a wet/dry filter system but the basic components consist of a pre-filter, bio-filter, and sump. An aquarium tank is setup so that water overflows through a tube which leads to the sump. The sump is an external tank which contains the pre-filter and bio-filter. Water flows to the top of the sump on one side where it goes through a pre-filter element such as a sponge or cloth to trap bigger debris. The water then flows or trickles down over a bio-filter media such as bio-balls. These plastic bio-filter media are specially designed so that natural bacteria can be produced. The trickling water over these bio-filters creates large amounts of air which helps the bacteria grow. Such bacteria is commonly referred to as beneficial bacteria as they consume the toxins that are produced by the fish.

Once the water goes through the bio-filter, it collects at the bottom of the sump where a water pump redistributes the water back into the tank. As the basic concept behind the filtration is all natural, the process is highly efficient and requires less maintenance.

Wet/dry filters rely on the growth of bacteria, therefore, use of this system in a new tank requires care. This includes letting the water filter through the tank for several weeks in the presence of a food source for the bacteria.

A small number of hardy fish can be introduced to the tank to act as a source of ammonia while the bacterial colony grows large enough. During the maturation process the fish should be closely observed and, if possible, the water tested for ammonia and nitrite and corrective action taken when toxic levels are reached.

Bottled ammonia can be used as an alternative to hardy fish and such "fishless cycling" of a new aquarium is increasingly being recommended by responsible fish keepers.

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Barbs

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: ***Barbus*** Cuvier, 1816
Type Species: Cyprinus barbus, Linnaeus, 1758
Common Species: Barbus barbus (Barbel), Barbus brevipinnis (Shortfin Barb), Barbus callipterus (Clipper Barb), Barbus grypus (Shabut), Barbus tetrazona (Tiger Barb

- See species sub-section

Barbus[1] is a genus of fish in the Cyprinidae family.

The type species of this genus is the barbel, *Cyprinus barbus*, now called *Barbus barbus*.

Members of ***Barbus*** have a great deal of similarity to the genus *Puntius* and many species have been relocated back and forth in taxonomic debates.

Some species are commonly referred to as the Barb or barbel. The name comes from the fact that most of the members of the genera have a pair of barbels on their mouths which they sometimes use to search for food at the bottom of the water.

Contents

- 1 Reclassification of Barbs
- 2 Species
- 3 References

Reclassification of Barbs

Historically, fish commonly known as barbs were members of the genus *Barbus*, more recently many 'barbs' (including common aquarium species) have been reclassified into the genus *Puntius* and other genera.

Species

There are numerous species.[2]

B. ablabes (Bleeker, 1863)
B. aboinensis Boulenger, 1911
B. acuticeps Matthes, 1959
B. acutirostris Bini, 1940
B. afrohamiltoni Crass, 1960
B. afrovernayi Nichols and Boulton, 1927
B. albanicus Steindachner, 1870
B. aliciae Bigorne and Lévêque, 1993
B. alluaudi Pellegrin, 1909
B. aloyi Roman, 1970
B. altianalis Boulenger, 1900
B. altidorsalis Boulenger, 1908
B. amanpoae Lambert, 1961
B. amatolicus Skelton, 1990
B. andrewi Barnard, 1937
B. anema Boulenger, 1903
B. annectens Gilchrist and Thompson, 1917
B. anniae Lévêque, 1983
B. anoplus Weber, 1897
B. ansorgii Boulenger, 1904
B. apleurogramma
B. gestetneri Banister and Bailey, 1979
B. girardi Boulenger, 1910
B. goktschaicus Kessler, 1877
B. gorgorensis Bini, 1940
B. gorguari Rüppell, 1835
B. graecus Steindachner, 1895
B. graellsii Steindachner, 1866
B. greenwoodi Poll, 1967
B. gruveli Pellegrin, 1911
B. grypus Heckel, 1843
B. guildi Loiselle, 1973
B. guineensis Pellegrin, 1913
B. guirali Thominot, 1886
B. guiraonis Steindachner, 1866
B. gulielmi Boulenger, 1910
B. gurneyi Günther, 1868
B. haasi Mertens, 1925
B. haasianus David, 1936
B. habereri Steindachner, 1912
B. harterti Günther, 1901
B. holotaenia Boulenger, 1904
B. oligogrammus David, 1937
B. olivaceus Seegers, 1996
B. osseensis Nagelkerke and Sibbing, 2000
B. owenae Ricardo-Bertram, 1943
B. oxyrhynchus Pfeffer, 1889
B. pagenstecheri Fischer, 1884
B. pallaryi Pellegrin, 1919
B. pallidus Smith, 1841
B. paludinosus Peters, 1852
B. papilio Banister and Bailey, 1979
B. parablabes Daget, 1957
B. parajae Van den Bergh and Teugels, 1998
B. parawaldroni Lévêque, Thys van den Audenaerde and Traoré, 1987
B. paytonii Boulenger, 1911
B. pellegrini Poll, 1939
B. peloponnesius Valenciennes in Cuvier and Valenciennes, 1842
B. perince Rüppell, 1835
B. petchkovskyi Poll, 1967

Boulenger, 1911
B. apoensis Banister and Clarke, 1977
B. arabicus Trewavas, 1941
B. arambourgi Pellegrin, 1935
B. arcislongae Keilhack, 1908
B. argenteus Günther, 1868
B. aspilus Boulenger, 1907
B. aspius Boulenger, 1912
B. atakorensis Daget, 1957
B. atkinsoni Bailey, 1969
B. atromaculatus Nichols and Griscom, 1917
B. bagbwensis Norman, 1932
B. balcanicus Kotlík, Tsigenopoulos, Ráb and Berrebi, 2002
B. barbulus Heckel, 1847 (Linnaeus, 1758)
B. barnardi Jubb, 1965
B. barotseensis Pellegrin, 1920
B. batesii Boulenger, 1903
B. baudoni Boulenger, 1918
B. bawkuensis Hopson, 1965
B. bellcrossi Jubb, 1965
B. bifrenatus Fowler, 1935
B. bigornei Lévêque, Teugels and Thys van den Audenaerde, 1988
B. hospes Barnard, 1938
B. huguenyi Bigorne and Lévêque, 1993
B. huloti Banister, 1976
B. hulstaerti Poll, 1945
B. humeralis Boulenger, 1902
B. humilis Boulenger, 1902
B. humphri Banister, 1976
B. hypsolepis Daget, 1959
B. inaequalis Lévêque, Teugels and Thys van den Audenaerde, 1988
B. innocens Pfeffer, 1896
B. intermedius Rüppell, 1835
B. issenensis Pellegrin, 1922
B. iturii Holly, 1929
B. jacksoni Günther, 1889
B. jae Boulenger, 1903
B. janssensi Poll, 1976
B. jubbi Poll, 1967
B. kamolondoensis Poll, 1938
B. kersin Heckel, 1843
B. kerstenii Peters, 1868
B. kessleri (Steindachner, 1866)
B. kissiensis Daget, 1954
B. ksibi Boulenger, 1905
B. kuiluensis Pellegrin, 1930
B. lacerta Heckel, 1843
B. lagensis (Günther, 1868)
B. petitjeani Daget, 1962
B. platydorsus Nagelkerke and Sibbing, 1997
B. platyrhinus Boulenger, 1900
B. plebejus Bonaparte, 1839
B. pleurogramma Boulenger, 1902
B. pleuropholis Boulenger, 1899
B. pobeguini Pellegrin, 1911
B. poechii Steindachner, 1911
B. prespensis Karaman, 1924
B. prionacanthus Mahnert and Géry, 1982
B. profundus Greenwood, 1970
B. progenys Boulenger, 1903
B. pseudognathodon Boulenger, 1915
B. pseudotoppini Seegers, 1996
B. puellus Nichols and Boulton, 1927
B. pumilus Boulenger, 1901
B. punctitaeniatus Daget, 1954
B. pygmaeus Poll and Gosse, 1963
B. quadrilineatus David, 1937
B. quadripunctatus Pfeffer, 1896
B. radiatus Peters, 1853
B. raimbaulti Daget,

B. boboi Schultz, 1942
B. bocagei Steindachner, 1864
B. borysthenicus Dybowski, 1862
B. bourdariei Pellegrin, 1928
B. brachycephalus Kessler, 1872
B. brachygramma Boulenger, 1915
B. brazzai Pellegrin, 1901
B. brevicephalus Nagelkerke and Sibbing, 1997
B. breviceps Trewavas, 1936
B. brevidorsalis Boulenger, 1915
B. brevilateralis Poll, 1967
B. brevipinnis Jubb, 1966
B. brevispinis Holly, 1927
B. brichardi Poll and Lambert, 1959
B. bynni (Forsskål, 1775)
B. cadenati Daget, 1962
B. calidus Barnard, 1938
B. callensis Valenciennes in Cuvier and Valenciennes, 1842
B. callipterus Boulenger, 1907 -- clipper barb
B. camptacanthus (Bleeker, 1863)
B. candens Nichols and Griscom, 1917
B. caninus Bonaparte,
B. lamani Lönnberg and Rendahl, 1920
B. laticeps Pfeffer, 1889
B. lauzannei Lévêque and Paugy, 1982
B. leonensis Boulenger, 1915
B. lepineyi Pellegrin, 1939
B. leptopogon Schimper, 1834
B. liberiensis Steindachner, 1894
B. lineomaculatus Boulenger, 1903
B. longiceps Valenciennes in Cuvier and Valenciennes, 1842
B. longifilis Pellegrin, 1935
B. longissimus Nagelkerke and Sibbing, 1997
B. lornae Ricardo-Bertram, 1943
B. lorteti Sauvage, 1882
B. loveridgii Boulenger, 1916
B. luapulae Fowler, 1958
B. lucius Boulenger, 1910
B. lufukiensis Boulenger, 1917
B. luikae Ricardo, 1939
B. lujae Boulenger, 1913
B. lukindae Boulenger, 1915
B. lukusiensis David and Poll, 1937
B. luluae Fowler, 1930
B. luteus (Heckel,
1962
B. reinii Günther, 1874
B. rhinophorus Boulenger, 1910
B. rocadasi Boulenger, 1910
B. rohani Pellegrin, 1921
B. rosae Boulenger, 1910
B. roussellei Ladiges and Voelker, 1961
B. rouxi Daget, 1961
B. roylii Boulenger, 1912
B. ruasae Pappenheim in Pappenheim and Boulenger, 1914
B. rubrostigma Poll and Lambert, 1964
B. sacratus Daget, 1963
B. salessei Pellegrin, 1908
B. schoutedeni Poll and Lambert, 1961
B. sclateri Günther, 1868
B. serengetiensis Farm, 2000
B. serra Peters, 1864
B. sexradiatus Boulenger, 1911
B. somereni Boulenger, 1911
B. stanleyi Poll and Gosse, 1974
B. stappersii Boulenger, 1915
B. stauchi Daget, 1967
B. steindachneri Almaça, 1967
B. stigmasemion Fowler, 1936
B. stigmatopygus

1839
B. canis Valenciennes in Cuvier and Valenciennes, 1842
B. capito (Güldenstädt, 1773)
B. carcharhinoides Stiassny, 1991
B. cardozoi Boulenger, 1912
B. carens Boulenger, 1912
B. carottae (Bianco, 1998)
B. carpathicus Kotlík, Tsigenopoulos, Ráb and Berrebi, 2002
B. castrasibutum Fowler, 1936
B. catenarius Poll and Lambert, 1959
B. caudosignatus Poll, 1967
B. caudovittatus Boulenger, 1902
B. cercops Whitehead, 1960
B. chicapaensis Poll, 1967
B. chiumbeensis Pellegrin, 1936
B. chlorotaenia Boulenger, 1911
B. choloensis Norman, 1925
B. ciscaucasicus Kessler, 1877
B. citrinus Boulenger, 1920
B. claudinae De Vos and Thys van *den Audenaerde, 1990*
B. clauseni Thys van den Audenaerde, 1976
1843)
B. macedonicus Karaman, 1928
B. machadoi Poll, 1967
B. macinensis Daget, 1954
B. macroceps Fowler, 1936
B. macrolepis Pfeffer, 1889
B. macrophtalmus Bini, 1940
B. macrops Boulenger, 1911
B. macrotaenia Worthington, 1933
B. magdalenae Boulenger, 1906
B. magniatlantis Pellegrin, 1919
B. malacanthus Pappenheim, 1911
B. manicensis Pellegrin, 1919
B. mariae Holly, 1929
B. marmoratus David and Poll, 1937
B. martorelli Roman, 1970
B. massaensis Pellegrin, 1922
B. matthesi Poll and Gosse, 1963
B. mattozi Guimarães, 1884
B. mawambi Pappenheim *Pappenheim and Boulenger, 1914*
B. mawambiensis Steindachner, 1911
B. mbami Holly, 1927
B. mediosquamatus Poll, 1967
Boulenger, 1903
B. subinensis Hopson, 1965
B. sublimus Coad and Najafpour, 1997
B. sublineatus Daget, 1954
B. subquincunciatus Günther, 1868
B. surkis Rüppell, 1835
B. sylvaticus Loiselle and Welcomme, 1971
B. syntrechalepis (Fowler, 1949)
B. taeniopleura Boulenger, 1917
B. taeniurus Boulenger, 1903
B. tanapelagius Graaf, Dejen, Sibbing and Osse, 2000
B. tangandensis Jubb, 1954
B. tauricus Kessler, 1877
B. tegulifer Fowler, 1936
B. tetrastigma Boulenger, 1913
B. thamalakanensis Fowler, 1935
B. thessalus Stephanidis, 1971
B. thysi Trewavas, 1974
B. tiekoroi Lévêque, Teugels and Thys van inden Audenaerde, 1987
B. tomiensis Fowler, 1936
B. tongaensis Rendahl, 1935
B. toppini Boulenger, 1916
B. trachypterus

B. collarti Poll, 1945
B. comizo Steindachner, 1864
B. compiniei (Sauvage, 1879)
B. condei Mahnert and Géry, 1982
B. congicus Boulenger, 1899
B. crassibarbis Nagelkerke and Sibbing, 1997
B. cyclolepis Heckel, 1837
B. dainellii Bini, 1940
B. dartevellei Poll, 1945
B. deguidei Matthes, 1964
B. deserti Pellegrin, 1909
B. dialonensis Daget, 1962
B. diamouanganai Teugels and Mamonekene, 1992
B. ditinensis Daget, 1962
B. dorsolineatus Trewavas, 1936
B. eburneensis Poll, 1941
B. elephantis Boulenger, 1907
B. ensis Boulenger, 1910
B. erubescens Skelton, 1974
B. erythrozonus Poll and Lambert, 1959
B. ethiopicus Zolezzi, 1939
B. euboicus Stephanidis, 1950
B. eurystomus Keilhack,
B. megastoma Nagelkerke and Sibbing, 1997
B. melanotaenia Stiassny, 1991
B. meridionalis Risso, 1827
B. microbarbis David and Poll, 1937
B. microcephalus Almaça, 1967
B. micronema Boulenger, 1904
B. microterolepis Boulenger, 1902
B. mimus Boulenger, 1912
B. miolepis Boulenger, 1902
B. mirabilis Pappenheim in Pappenheim and Boulenger, 1914
B. mocoensis Trewavas, 1936
B. mohasicus Pappenheim in Pappenheim and Boulenger, 1914
B. motebensis Steindachner, 1894
B. moulouyensis Pellegrin, 1924
B. multilineatus Worthington, 1933
B. mungoensis Trewavas, 1974
B. mursa (Güldenstädt, 1773)
B. musumbi Boulenger, 1910
B. myersi Poll, 1939
B. nanningsi (de Beaufort, 1933)
Boulenger, 1915
B. traorei Lévêque, Teugels and Thys van den Audenaerde, 1987
B. treurensis Groenewald, 1958
B. trevelyani Günther, 1877
B. trimaculatus Peters, 1852
B. trinotatus Fowler, 1936
B. trispiloides Lévêque, Teugels and Thys van den Audenaerde, 1987
B. trispilomimus Boulenger, 1907
B. trispilopleura Boulenger, 1902
B. trispilos (Bleeker, 1863)
B. tropidolepis Boulenger, 1900
B. truttiformis Nagelkerke and Sibbing, 1997
B. tsanensis Nagelkerke and Sibbing, 1997
B. turkanae Hopson and Hopson, 1982
B. tyberinus Bonaparte, 1839
B. umbeluziensis Groenewald, 1958
B. unitaeniatus Günther, 1866
B. urostigma Boulenger, 1917
B. urotaenia Boulenger, 1913
B. usambarae Lönnberg, 1907
B. vanderysti Poll, 1945
B. venustus Bailey,

1908

B. eutaenia Boulenger, 1904

B. evansi Fowler, 1930

B. fasciolatus Günther, 1868

B. fasolt Pappenheim in Pappenheim and Boulenger, 1914

B. figuigensis Pellegrin, 1913

B. foutensis Lévêque, Teugels and Thys van den Audenaerde, 1988

B. fritschii Günther, 1874

B. gananensis Vinciguerra, 1895

B. nasus Günther, 1874

B. neefi Greenwood, 1962

B. neumayeri Fischer, 1884

B. nigeriensis Boulenger, 1903

B. nigrifilis Nichols, 1928

B. nigroluteus Pellegrin, 1930

B. niokoloensis Daget, 1959

B. nounensis Van den Bergh and Teugels, 1998

B. nyanzae Whitehead, 1960

1980

B. viktorianus Lohberger, 1929

B. viviparus Weber, 1897

B. walkeri Boulenger, 1904

B. wellmani Boulenger, 1911

B. wurtzi Pellegrin, 1908

B. xanthopterus (Heckel, 1843)

B. yeiensis Johnsen, 1926

B. yongei Whitehead, 1960

B. zalbiensis Blache and Miton, 1960

B. zanzibaricus Peters, 1868

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Barbonymus

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: ***Barbonymus,*** Kottelat, 1999
Type Species: Barbus schwanenfeldii, Bleeker, 1853
Species: *Barbonymus altus (Red tailed tinfoil barb), Barbonymus gonionotus (Java barb), Barbonymus schwanenfeldii (Tinfoil barb)*

Barbonymus is a genus of fish in the Cyprinidae family. Its members are commonly referred to as barbs. The genus is relatively new, with many of its members reclassified from the *Barbus* and Barbodes genera. The type species is the tinfoil barb (*Barbus schwanenfeldii*, now called *Barbonymus schwanenfeldii*).

Puntius

Spotted barbs
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: ***Puntius***
Type Species: *Cyprinus sophore,* Hamilton, 1822
Species: See Species for a full list

Puntius[1] is a genus of fish in the Cyprinidae family of order Cypriniformes. The type species is *Cyprinus sophore* (the pool barb, now called *Puntius sophore*), and fish of this genus are known as the **spotted barbs**. The name *Puntius* comes from a local Bangla name for small cyprinids called *pungti*.

Fish of the genus ***Puntius*** are found in Southeast Asia and India, including Sri Lanka. The maximum size for an adult of this genus is less than 25cm, typically 15cm, and many species only achieve around 5cm adult length. In appearance they may resemble miniature carp and are often brightly coloured or patterned. The fish are omnivorous; their diet includes small insect larvae, worms and plant matter.

Breeding is by egg scattering and takes place close to the bottom, near or within areas of dense plant growth. They do not show parental care, and adults may eat the young.

Historically, many species of *Puntius* have been classified in several genera, including *Barbus*, and have "barb" common names such as the tiger barb and so on. Despite the reclassifications, the specific epithet remains the same.

Contents

- 1 In the aquarium
    - 1.1 Common aquarium species
- 2 Species
    - 2.1 P. cochonius sub group
- 3 References

In the aquarium

Many of these tropical barbs are commonly kept as inhabitants of a warm water aquarium, as many species are commonly available. They are easy to feed, taking a wide variety of foods including dried food. Many species are considered unsuitable in aquaria with slow-moving, long-finned tankmates.

Common aquarium species

Numerous small barbs are suited to aquaria.[2]

Puntius arulius (Arulius barb)
Puntius binotatus (Spotted barb)
Puntius chola (Swamp barb)
Puntius conchonius (Rosy barb)
Puntius denisonii (Red line torpedo barb)
Puntius dunckeri (Bigspot barb)
Puntius everetti (Clown barb)
Puntius fasciatus (Melon barb)
Puntius gelius (Golden barb)
Puntius hexazona (Sixband barb)
Puntius lateristriga (Spanner barb)
Puntius nigrofasciatus (Black ruby barb)
Puntius oligolepis (Checker barb)
Puntius partipentazona
Puntius pentazona (Pentazona barb)
Puntius phutunio (Spottedsail barb)
Puntius semifasciolatus (Gold barb)
Puntius sophore (Pool barb)
Puntius stoliczkanus (Tic-tac-toe barb)
Puntius terio (Onespot barb)
Puntius tetrazona (Tiger barb)
Puntius ticto (Ticto barb)
Puntius titteya (Cherry barb)
Puntius vittatus (Greenstripe barb)

Species

There are many species.[3]

P. amarus (Herre, 1924)
P. amphibius (Valenciennes, 1842) (Scarlet-banded barb)
P. anchisporus (Vaillant, 1902)
P. arenatus (Day, 1878)
P. arulius (Jerdon, 1849) (Arulius barb)
P. asoka Kottelat & Pethiyagoda, 1989 (Asoka barb)
P. aurotaeniatus (Tirant, 1885)
P. bandula Kottelat & Pethiyagoda, 1991 (Bandula barb)
P. bantolanensis (Day, 1914)
P. baoulan (Herre, 1926)
P. bimaculatus (Bleeker, 1863) (Redside barb)
P. binotatus (Valenciennes, 1842) (Spotted barb)
P. bovanicus (Day, 1878) (Bowany barb)
P. brevis (Bleeker, 1850)
P. burmanicus (Day, 1878)
P. carnaticus (Jerdon, 1849) (Carnatic carp)
P. cataractae (Fowler, 1934)
P. cauveriensis (Hora, 1937) (Cauvery barb)
P. chola (Hamilton,
P. disa (Herre, 1932)
P. dorsalis (Jerdon, 1849) (Long snouted barb)
P. dorsimaculatus (Ahl, 1923) (Blackline barb)
P. dunckeri (Ahl, 1929) (Bigspot barb)
P. endecanalis (Roberts, 1989
P. eugrammus (Silas, 1956) (Striped barb)
P. everetti (Boulenger, 1894) (Clown barb)
P. fasciatus (Jerdon, 1849) (Melon barb)
P. filamentosus (Valenciennes, 1844) (Blackspot barb)
P. flavifuscus (Herre, 1924)
P. foerschi (Kottelat, 1982)
P. fraseri (Hora & Misra, 1938) (Dharna barb)
P. guganio (Hamilton, 1822) (Glass-barb)
P. hemictenus (Jordan & Richardson, 1908)
P. herrei (Fowler, 1934)
P. hexazona (Weber & de Beaufort, 1912) (Sixband barb)
P. jacobusboehlkei (Fowler, 1958)
P. katolo (Herre, 1924)
P. kuchingensis (Herre, 1940)
P. lanaoensis (Herre,
P. melanostigma (Day, 1878) (Wynaad barb)
P. microps (Guenther, 1868)
P. montanoi Sauvage, 1881
P. mudumalaiensis (Menon & Rema Devi, 1992)
P. muzaffarpurensis (Srivastava, Verma & Sharma, 1977)
P. okae (Fowler, 1949)
P. oligolepis (Bleeker, 1853) (Checker barb)
P. ophicephalus (Raj, 1941) (Channa barb)
P. orphoides (Valenciennes, 1842) (Javaen barb)
P. parrah (Day, 1865)
P. partipentazona (Fowler, 1934)
P. paucimaculatus Wang & Ni, 1982
P. pentazona (Boulenger, 1894) (Pentazona barb)
P. pleurotaenia (Bleeker, 1863) (Black lined barb)
P. punjaubensis (Day, 1871)
P. rhombeus (Kottelat, 2000)
P. rhomboocellatus (Koumans, 1940)
P. roseipinnis (Valenciennes, 1842) (Pondicherry barb)

1822) (Swamp barb)
P. clemensi (Herre, 1924)
P. compressiformis (Cockerell, 1913)
P. coorgensis Jayaram, 1982
P. deccanensis Yazdani & Babu Rao, 1976 (Deccan barb)
P. denisonii (Day, 1865) (Red line torpedo barb)
1924)
P. lateristriga (Valenciennes, 1842) (Spanner barb)
P. leiacanthus (Bleeker, 1860)
P. lindog (Herre, 1924)
P. lineatus (Duncker, 1904) (Lined barb)
P. manalak (Herre, 1924)
P. manguaoensis (Day, 1914)
P. martenstyni Kottelat & Pethiyagoda, 1991 (Martenstyn's barb)
P. masyai (Smith, 1945)
P. sachsii (Ahl, 1923) (Goldfinned barb)
P. sahyadriensis (Silas, 1953) (Khavli barb)
P. sarana (Hamilton, 1822) (Olive barb)
P. semifasciolatus (Guenther, 1868) (Gold barb)
P. semifasciolatus var. schuberti
P. setnai (Chhapgar & Sane, 1992)
P. shalynius (Yazdani & Talukdar, 1975) (Shalyni barb)
P. sirang (Herre, 1932)
P. sophore (Hamilton, 1822) (Pool barb)
P. srilankensis (Senanayake, 1985) (Blotched filamented barb)
P. terio (Hamilton, 1822) (Onespot barb)
P. titteya (Deraniyagala, 1929) (Cherry barb)
P. tras (Herre, 1926)
P. tumba (Herre, 1924)
P. vittatus (Day, 1865) (Greenstripe barb)
P. waageni (Day, 1871)

P. cochonius sub group

P. conchonius (Hamilton, 1822) (Rosy barb)
P. cumingii (Guenther, 1868) (Two spot barb)
P. didi Kullander & Fang, 2005
P. gelius (Hamilton,
P. narayani (Hora, 1937) (Narayan barb)
P. nigrofasciatus (Guenther, 1868) (Black ruby barb)
P. phutunio (Hamilton, 1822) (Spottedsail barb)
P. punctatus
P. stoliczkanus (Day, 1871) (Tic-tac-toe barb)
P. tetrazona (Bleeker, 1855) (Tiger barb)
P. tiantian (Kullander & Fang), 2005
P. ticto (Hamilton, 1822) (Ticto barb)

1822) (Golden barb) *P. meingangbii*	*P. puntio (Hamilton, 1822)*	*P. ticto var. odessae*

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3. ^ Cyprinidae: Cyprininae: genus *Puntius* (2005).

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Carp

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genera: *Abramis, Aristichthys, Barbodes, Carassius, Cirrhinus, Ctenopharyngodon, Cyprinus, Epalzeorhynchos, Henicorhynchus, Hypophthalmichthys, Labeo, Mylopharyngodon,* and others

A **carp** is any of various freshwater fish of the family Cyprinidae. The common carp (Cyprinus carpio) is the most common and best-known species of carp. Originally from Asia, carp were introduced to England from western Europe during the 13th century, when they were cultivated mainly by monks. They were subsequently introduced into North America in 1877. Fish were released in ponds in Druid Hill Park in Baltimore, Maryland. Later, surplus populations were released in Washington D.C.. This was a project of Rudolf Hessel, a fish culturist in the employ of the United States Government. There was substantial favorable publicity and carp were widely introduced throughout the United States. Introduced Carp readily adapted to their new environment, spreading rapidly throughout any drainage area in which they were released. Carp have since become naturalized in almost every water in which they were introduced.

While tasty when grown in good water, carp can be riddled with small bones in unpredictable locations. Most carp have a fishy taste and are not considered to be good for eating in North America, although they are popular in restaurants in Japan and Taiwan where the fish are also considered to be signs of good fortune. Carp is a traditional Christmas Eve dish in the Czech Republic, Slovak Republic, Germany and Poland. The common carp is one of the most aquacultured consumption fish in the world, produced in the hundreds of thousands of tons annually.

Carp have food and angling value that is celebrated in some parts of the world. The carp has not yet gained gamefish status in the U.S. and are considered garbage among bass fisherman. In Europe on the other hand they are a trophy fish and lake owners are prepared to pay as much as £4000 or $7500 dollars for 40lb carp if fisherman fish for them on a catch and release basis.

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- 1 Controversy
- 2 Types of carp
- 3 In Legend
- 4 See also

Controversy

Carp have gained a negative reputation in the U.S., being blamed for everything from a decline in sportfish stocks to decreases in water quality. In Europe, Carp are preferred for sports fishing, as popular as Bass are in the United States. Separating the Carp's reputed impacts from its actual impacts can be difficult. There is little evidence yet to support the claims of Carp eating the spawn of other fish. Tales of Carp muddying waters and destroying water weed through their bottom-feeding habits are often exaggerated, becoming problematic only in the shallowest and muddiest of waters.

Types of carp

- Genus *Abramis*
    - Carp bream (*Abramis brama*)
- Genus *Aristichthys*:
    - Bighead carp (*Aristichthys nobilis*)
- Genus *Barbodes*:
    - Carnatic carp (*Barbodes carnaticus*)
- Genus *Carassius*:
    - Crucian carp (Carassius carassius)
    - Prussian carp (Carassius gibelio)
    - Goldfish (Carassius auratus)
- Genus *Cirrhinus*:
    - Chinese mud carp (Cirrhinus chinensis)
    - Deccan white carp (Cirrhinus fulungee)
    - Hora white carp (Cirrhinus macrops)
    - Small scale mud carp (Cirrhinus microlepis)
    - Mud carp (Cirrhinus molitorella)
- Genus *Ctenopharyngodon*:
    - Grass carp (*Ctenopharyngodon idellus*)
- Genus *Culter*:
    - Predatory carp (*Culter erythropterus*)
- Genus *Cyprinus*:
    - Common carp, Koi (*Cyprinus carpio*)
- Genus *Epalzeorhynchos*:
    - Red-tailed black shark (Epalzeorhynchos bicolor)
    - Red-finned black shark or Rainbow shark (Epalzeorhynchos frenatus)
- Genus *Henicorhynchus*:
    - Siamese mud carp (*Henicorhynchus siamensis*)
- Genus *Hypophthalmichthys*:
    - Silver carp (*Hypophthalmichthys molitrix*)
- Genus *Labeo*:
    - African carp (Labeo coubie)
    - Fringed-lipped peninsula carp (Labeo fimbriatus)
    - Bigmouth carp (Labeo kontius)
- Genus *Mylopharyngodon*:
    - Black carp (*Mylopharyngodon piceus*)

In Legend

In Chinese Mythology, there is said to be a place called Dragon's Gate. Dragon's Gate resides at the top of a waterfall. It is said if a carp can jump over the waterfall from the waters below, it will become a beautiful dragon.

- Oily fish
- Asian carp (a term used for one of 5 different species of carp)

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Goldfish

Conservation status: Secure

Kingdom: Animalia

Phylum: Chordata

Class: Actinopterygii

Order: Cypriniformes

Family: Cyprinidae

Genus: *Carassius*

Species: *C. auratus*

Subspecies: ***C. a. auratus/C. a. gibelio***

Trinomial name: ***Carassius auratus,*** (Linnaeus, 1758)

The **Goldfish** (*Carassius auratus*) was one of the earliest fish to be domesticated, and is still one of the most commonly kept aquarium fish. A relatively small member of the carp family (which also includes the koi carp and the crucian carp), the goldfish is a domesticated version of a dark-gray/olive/brown carp native to east Asia (first domesticated in China)[1] that was introduced to Europe in the late 17th century. The mutation that gave rise to the goldfish is also known from other cyprinid species, such as common carp and tench.

Goldfish may grow to a maximum length of 23 inches (59 cm) and a maximum weight of 9.9 pounds (4.5 kg), although this is rare; most individual goldfish grow to under half this size. In optimal conditions, goldfish may live more than 20 years (the world record is 49 years); however, most household goldfish generally only live six to eight years.[2]

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- 1 History
- 2 Varieties of domesticated goldfish
    - 2.1 Chinese Goldfish classification
- 3 Goldfish in ponds
- 4 Goldfish in aquaria
- 5 Feeding
- 6 Behavior
- 7 Native environment
- 8 Breeding
- 9 Mosquito control
- 10 Edibility and cruelty
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- 13 References

History

During the Tang Dynasty, it was popular to raise carp in ponds. As the result of a dominant genetic mutation, one of these carp displayed "gold" (actually yellowish orange) rather than silver coloration. People began to breed the gold variety instead of the silver variety, and began to display them in small containers. The fish were not kept in the containers permanently, but would be kept in a larger body of water, such as a pond, and only for special occasions at which guests were expected would they be moved to the smaller container.[1]

In 1162, the empress of the Song Dynasty ordered the building of a pond to collect the red and gold variety of those carp. By this time, people outside the royal family were forbidden to keep goldfish of the gold (yellow) variety, yellow being the royal color. This probably is the reason why there are more orange goldfish than yellow goldfish, even though the latter are genetically easier to breed. [3]

As time passed, more mutations occurred, producing new color variations, and fancier varieties of goldfish were developed. The occurrence of other colors was first recorded in 1276. The first occurrence of fancy tailed goldfish was recorded in the Ming dynasty. In 1502, goldfish were introduced to Japan, where the Ryukin and Tosakin varieties were developed.

In 1611, goldfish were introduced to Portugal and from there to other parts of Europe. Goldfish were first introduced to North America in 1874 and quickly became popular in the United States.

Varieties of domesticated goldfish

Selective breeding over centuries has produced several color variations, some of them far removed from the "golden" color of the originally domesticated fish. There are also different body shapes, fin and eye configurations. Some extreme versions of the goldfish do need to be kept in an aquarium — they are much less hardy than varieties closer to the "wild" original. However, some variations are hardier, such as the Shubunkin. The main varieties are:

Common
Black Moor
Bubble Eye
Celestial Eye
Comet
Fantail
Calico Fantail
Lionhead
Oranda
Pearlscale
Pompom
Ryukin
Shubunkin
Telescope Eye
Ranchu
Panda Moor
Veiltail

Chinese Goldfish classification

In Chinese goldfish keeping, goldfish are classified into 4 main types, which are not commonly used in the west.

- Dragon Eye - Goldfish with extended eyes, e.g. Black Moor, Bubble Eye, and Telescope Eye
- Egg - Goldfish without a dorsal fin. e.g. Lionhead (note that a Bubble Eye without a dorsal fin belongs to this group)
- Wen - Goldfish with dorsal fin and a fancy tail. e.g. Veiltail ("Wen" is also the name of the characteristic headgrowth on such strains as Oranda and Lionhead)
- Ce (may also be called "grass") - Goldfish without anything fancy. This is the type that is usually used in Japanese carnivals, especially for "goldfish scoops".
- Jikin and Wakin - Goldfish with double tails, but with the body shapes of comets.

Goldfish in ponds

Goldfish are popular pond fish, since they are small, inexpensive, colourful, and very hardy. In a pond, they may even survive if brief periods of ice form on the surface, as long as there is enough oxygen remaining in the water and the pond does not freeze solid.

Common goldfish, London and Bristol shubunkins, Jikin, Wakin, comet and sometimes fantail can be kept in a pond all year round in temperate and subtropical climates. Moor, veiltail, oranda and lionhead are only safe in the summer.

Small to large ponds are fine though the depth should be at least 80 cm (30 in) to avoid freezing. During winter, goldfish will become sluggish, stop eating, and often stay on the bottom of the tank. This is completely normal; they will become active again in the spring. A filter is important to clear waste and keep the pond clean. Plants are essential as they act as part of the filtration system, as well as a food source for the fish. Plants are furthermore beneficial since they raise oxygen levels in the water.

Compatible fish include rudd, tench, orfe and koi, but the latter will require specialized care. Ramshorn snails are helpful by eating any algae that grows in the pond. It is of great importance to introduce fish that will consume excess goldfish eggs in the pond, such as orfe. Without some form of population control, goldfish ponds can easily become overstocked. Koi may also interbreed to produce a sterile new fish.

Goldfish in aquaria

The goldfish is usually classified as a coldwater fish, and it can live in an unheated aquarium. Like most carp, goldfish produce a large amount of waste both in their feces and through their gills, releasing harmful chemicals into the water. This also happens because goldfish cannot digest an excess of proteins, unlike most tropical fish[citation needed]. Build-up of this waste to toxic levels can occur in a relatively short period of time, which is often the cause of a fish's sudden death. It may be the amount of water surface area, not the water volume, that decides how many goldfish may live in a container, because this determines how much oxygen diffuses and dissolves from the air into the water; one square foot of water surface area for every inch of goldfish length (370 cm^2/cm). If the water is being further aerated by way of water pump, filter or fountain, more goldfish may be kept in the container.

Goldfish may be coldwater fish, but this does not mean they can tolerate rapid changes in temperature. The sudden shift in temperature that comes at night, for example in an office building where a goldfish might be kept in a small office tank, could kill them, especially in winter. Conversely, temperatures over 25 °C (77 °F) can be extremely damaging for goldfish (this is the main reason why they shouldn't be kept in tropical tanks).

The popular image of a goldfish in a small fishbowl is an enduring one. Unfortunately, the risk of stunting, deoxygenation, ammonia/nitrite poisoning caused by such a small environment means that this is hardly a suitable home for any species of fish, and some countries have banned the sale of bowls of that type under animal rights legislation.

The supposed reputation of goldfish dying quickly is often due to poor care amongst uninformed buyers looking for a "cheap" pet. The true lifespan of a well-cared-for goldfish in captivity can extend beyond 10 years.

Fancy goldfish are unlikely to survive for long in the wild as they are handicapped by their bright fin colors; however it is not beyond the bounds of possibility that such a fish, especially the more hardy varieties such as the Shubunkin, can survive long enough to breed with its wild cousins. Common and comet goldfish can survive, and even thrive, in any climate in which a pond for them can be created. Introduction of wild goldfish can cause problems for native species. Within three breeding generations the vast majority of the goldfish spawn will have reverted to their natural olive color. Since they are carp, goldfish are also capable of breeding with certain other species of carp and creating hybrid species.

Research by Dr. Yoshiichi Matsui, a professor of fish culture at Kinki University in Japan, suggests that there are subtle differences which demonstrate that while the crucian carp is the ancestor of the goldfish, they have sufficiently diverge to be considered separate species.[4]

Feeding

Like most fish, goldfish are opportunistic feeders. When an excess of food is offered, they will produce more waste and feces, partly due to incomplete digestion of protein. Overfed fish can sometimes be recognized by feces trailing from their cloaca. Goldfish need only be fed as much food as they can consume in three to four minutes, and no more than twice a day. Extreme overfeeding can be fatal, typically by bursting of the intestines. This happens most often with selectively bred goldfish, which have a convoluted intestinal tract as opposed to a straight one in common goldfish. Novice fishkeepers who have newly purchased ruykin, fantail, oranda, lionhead or other "fancy" goldfish will need to watch their fish carefully for a few days, as it is important to know how much the goldfish will eat in a few minutes of time.

Special goldfish food has a lower protein and higher carbohydrate content. It is sold in two consistencies - flakes that float at the top of the aquarium, and pellets that sink slowly to the bottom.

Goldfish enthusiasts will supplement this diet with shelled peas (with outer skins removed), blanched green leafy vegetables, and bloodworms. Young goldfish also benefit from the addition of brine shrimp to their diet.

Behavior

Behavior can vary widely both because goldfish are housed in a variety of environments, and because their behavior can be conditioned by their owners. A common misconception that goldfish only have a three second memory has been proven completely false.[5]

Scientific studies done on the matter have shown that goldfish have strong associative learning abilities, as well as social learning skills. In addition, their strong visual acuity allows them to distinguish between different humans. It is quite possible that owners will notice the fish react favorably to them (swimming to the front of the glass, swimming rapidly around the tank, and going to the surface mouthing for food) while hiding when other people approach the tank. Over time, goldfish should learn to associate their owners and other humans with food, often "begging" for food whenever their owners approach.

Goldfish also display a range of social behaviors. When new fish are introduced to the tank, aggressive social behaviors may sometimes be seen, such as chasing the new fish, or fin nipping. These usually stop within a few days. Fish that have been living together are often seen displaying schooling behavior, as well as displaying the same types of feeding behaviors. Goldfish may display similar behaviors when responding to their reflections in a mirror.

Goldfish that have constant visual contact with humans also seem to stop associating them as a threat. After being kept in a tank for several weeks, it becomes possible to "pet" a goldfish on the head, feed it by hand, or even cup a hand around it without it reacting in a frightened manner. Some goldfish have been trained to swim through mazes, push a ball through a hoop, or even swim in a synchronized routine by their owners.[6]

Goldfish have behaviors, both as groups and as individuals that stem from native carp behavior. They are a generalist species with varied feeding, breeding, and predators avoidance behaviours that contribute to their success in the environment. As fish they can be described as "friendly" towards each other, very rarely will a goldfish harm another goldfish, nor do the males harm the females during breeding. The only real threat that goldfish present to each other is in food competition. Commons, comets, and other faster varieties can easily eat all the food during a feeding before fancy varieties can reach it. This can be a problem that leads to stunted growth or possible starvation of fancier varieties when they are kept in a pond with their single-tailed brethren. As a result, when mixing breeds in an aquarium environment, care should be taken to combine only breeds with similar body type and swim characteristics.

Native environment

Goldfish natively live in ponds, and other slow or still moving bodies of water in depths up to 20 m (65 ft). Their native climate is subtropical to tropical and they live in freshwater with a pH of 6.0–8.0, a water hardness of 5.0–19.0 dGH, and a temperature range of 40 to 106 °F (4 to 41 °C) although they will not survive long at the higher temperatures. They are considered ill-suited even to live in a heated tropical fish tank, as they are used to the greater amount of oxygen in unheated tanks, and some believe that the heat burns them. However, goldfish have been observed living for centuries in outdoor ponds in which the temperature often spikes above 86 °F (30 °C). When found in nature, the goldfish are actually an olive green color.

In the wild, the diet consists of crustaceans, insects, and various plant matter.

While it is true that goldfish can survive in a fairly wide temperature range, the optimal range for indoor fish is 68 to 75 °F (20 to 23 °C). Pet goldfish, as with many other fish, will usually eat more food than it needs if given, which can lead to fatal intestinal blockage. They are omnivorous and do best with a wide variety of fresh vegetables and fruit to supplement a flake or pellet diet staple.

Sudden changes in water temperature can be fatal to any fish, including the goldfish. When transferring a store-bought goldfish to a pond or a tank, the temperature in the storage container should be equalized by leaving it in the destination container for at least 20 minutes before releasing the goldfish. In addition, some temperature changes might simply be too great for even the hardy goldfish to adjust to. For example, buying a goldfish in a store, where the water might be 70 °F (approximately 21 °C), and hoping to release it into your garden pond at 40 °F (4 °C) will probably result in the death of the goldfish, even if you use the slow immersion method just described. A goldfish will need a lot more time, perhaps days or weeks, to adjust to such a different temperature.

Because goldfish like to eat live plants, their presence in an aquarium can be quite a problem. Only a few of the aquarium plant species can survive in a tank with goldfish, for example Cryptocoryne and Anubias species, but they require special attention so that they are not uprooted. Fake plants are often more durable, but the plant branches can often irritate or harm a fish if it comes in contact with them.

Breeding

Goldfish, like all cyprinids, lay eggs. They produce adhesive eggs that attach to aquatic vegetation. The eggs hatch within 48 to 72 hours, releasing fry large enough to be described as appearing like "an eyelash with two eyeballs". Within a week or so, the fry begin to look more like a goldfish in shape, although it can take as much as a year before they develop a mature goldfish color; until then they are a metallic brown like their wild ancestors. In their first weeks of existence, the fry grow remarkably fast - an adaptation born of the high risk of getting devoured by the adult goldfish (or other fish and insects) in their environment.

Goldfish can only grow to sexual maturity if given enough water and the right nutrition. However if kept well, they may breed indoors. Breeding usually happens after a significant change in temperature, often in spring. Eggs should then be separated into another tank, as the parents will likely eat any of their young that they happen upon. Dense plants such as *Cabomba* or *Elodea* or a spawning mop are used to catch the eggs.

Most goldfish can and will breed if left to themselves, particularly in pond settings. Males chase the females around, bumping and nudging them in order to prompt the females to release her eggs, which the males then fertilize. Due to the strange shapes of some extreme modern bred goldfish, certain types can no longer breed among themselves. In these cases, a method of artificial breeding is used called "hand stripping". This method keeps the breed going, but can be dangerous and harmful to the fish if not done correctly.

Mosquito control

Like some other popular aquarium fish, such as the guppy, goldfish and other carp are frequently added to stagnant bodies of water in order to reduce the mosquito populations in some parts of the world, especially to prevent the spread of West Nile Virus, which relies on mosquitoes to migrate. However, the introduction of goldfish has often had negative consequences for local ecosystems.[7]

Edibility and cruelty

Although edible, goldfish are rarely eaten. A fad among North American college students for many years was swallowing goldfish as a stunt and as an initiation process for fraternities. The first recorded instance was in 1939 at Harvard University.[8] The practice gradually fell out of popularity over the course of several decades and is no longer continued.

In many countries, the operators of carnivals and fairs commonly give goldfish away in plastic bags as prizes for winning games. In the United Kingdom, the government proposed banning this practice as part of its Animal Welfare Bill,[9][10] though this has since been amended to only prevent goldfish being given as prizes to unaccompanied minors.[11] However, in Rome, Italy, the city passed a law in late 2005, which banned the use of goldfish or other animals as carnival prizes. Rome has also banned the keeping of goldfish in "goldfish bowls", on the premise that it's cruel to the fish to live in such a small, confined space.[12]

Killing fish humanely for human consumption or benign purposes (such as putting down an ill fish) is still legal in most countries (provided that the fish is not a protected fish caught in the wild, a fish in protected reserves or in water where the person concerned has no right to collect the fish). In the United Kingdom, it is illegal to sell live fish (including goldfish) as "feeder fish" for consumption by other animals.

See also

- Aquarium
- Carp
- List of freshwater aquarium plant species for plant species compatible with a goldfish

Notes

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Catfishes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Siluriformes**
Families: *Akysidae, Amblycipitidae, Amphiliidae, Ariidae, Aspredinidae, Astroblepidae, Auchenipteridae, Bagridae, Callichthyidae, Cetopsidae, Chacidae, Clariidae, Claroteidae, Cranoglanididae, Diplomystidae, Doradidae, Erethistidae, Hypophthalmidae, Ictaluridae, Lacantuniidae, Loricariidae, Malapteruridae, Mochokidae, Nematogenyidae, Pangasiidae, Parakysidae, Pimelodidae, Plotosidae, Pseudopimelodidae, Schilbeidae, Scoloplacidae, Siluridae, Sisoridae, Trichomycteridae*

Catfish (order **Siluriformes**) are a diverse group of fish. Named for their prominent barbels, which give the image of cat-like whiskers, they are found primarily in freshwater environments of all kinds, with species on every continent except Antarctica. Some species from the families Ariidae and Plotosidae are also found in marine environments. They feature some of the smallest known vertebrates, including the candiru, the only vertebrate parasite to attack humans, as well as Pangasianodon gigas, the largest reported freshwater fish. There are armour-plated types and also naked types, but they do not have scales. Not all catfish families have prominent barbels; what defines a fish as being in the order Siluriformes are certain features of the skull and swimbladder.

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Physical characteristics

Catfish have no scales. All catfish, except members of Malapteruridae (electric catfish), possess a strong, hollow, bonified leading ray on their dorsal and pectoral fins, through which a stinging protein can be delivered if the fish is irritated. In members of the family Plotosidae, and of the genus Heteropneustes, this protein is so strong it may hospitalize humans unfortunate enough to receive a sting.

Catfish, which have a sweet, mild flesh, are important as food fish throughout the world. Ictalurids are cultivated in North America (especially in the Deep South, with Mississippi being the largest domestic catfish producer)[1] while Clariids and Pangasiids are heavily cultured in Africa and Asia. Farmed Pangasius can sometimes be found in US supermarkets. However, the fish must be labeled as "Basa fish" (instead of catfish) due to measures intended to protect the American catfish farming industry.

Representatives of the genus *Ictalurus* have been misguidedly introduced into European waters in the hope of obtaining a sporting and a food resource. However, the European stock of American catfishes has not achieved the dimensions of these fishes in their native waters, and have only increased the ecological pressure on native European fauna. Clarias spp. have also been introduced in the freshwaters of Florida, with the voracious catfish becoming a major alien pest there.

There is a large and growing ornamental fish trade, with hundreds of species of catfish, especially the genus *Corydoras*, being a popular component of many aquaria.

Size

Catfish range in size and behavior from the heaviest, the giant Mekong catfish in Southeast Asia and the longest, the wels catfish of Eurasia, to detritivores (species that eat dead material on the bottom), and even to a tiny parasitic species commonly called the candiru, *Vandellia cirrhosa*.

The wels catfish, Silurus glanis, is the only native catfish species of Europe, besides the much smaller related Aristotle catfish found in Greece. Mythology and literature record wels catfish of astounding proportions, yet to be scientifically proved. The average size of the species is about 1.2 m to 1.6 m, and fish more than 2 m are very rare. The largest specimens on record measure more than 2.5 m in length and sometimes exeeded 100 kg. The wels catfish was introduced to Britain, Italy, Spain, Greece and some other countries during the last century. The species has flourished in the warm lakes and rivers of Southern Europe. The River Danube, River Po in Italy and the River Ebro in Spain are famous for huge wels catfish, which grow up to 2 m. These habitats contain plenty of food and lack natural predators.

A very large wels catfish was caught by Kevin Maddocks on August 6, 1999, recorded at 91.62 kg (202 lb). Tim Pruitt of Illinois caught the largest blue catfish, Ictalurus furcatus, in the Mississippi River on May 22, 2005 that weighed 56.25 kg (124 lb). The largest flathead catfish, Pylodictis olivaris, ever caught was in Independence, Kansas, weighing 56 kg (123 lb 9 oz). However, these records pale in comparison to a giant Mekong catfish caught in northern Thailand in May 1, 2005 and reported to the press almost 2 months later, that weighed 293 kg (646 lb). This is the largest giant Mekong catfish caught, but only since Thai officials started keeping records in 1981 [2]. The giant Mekong catfish are not well studied since they live in developing countries and it is quite possible that they can grow even larger.

Family

Catfish belong to a superorder called the Ostariophysi, which also includes the Cypriniformes, Characiformes, Gonorynchiformes and Gymnotiformes (although some place Gymnotiformes as a sub-order of Siluriformes). As of 2005 there are 37 catfish families, and around 2,000 species have been described, although this number is in constant flux due to taxonomic work on the order.

In June, 2005, researchers named the 37th family of catfish, Lacantuniidae, only the third new family of fish distinguished in the last 70 years (others being the coelacanth in 1938 and the megamouth shark in 1983). The new species in Lacantuniidae, Lacantunia enigmatica, was found in the Lacantun river in Chiapas, Mexico.

Southern tradition

In the southeast of the United States, catfish is an extremely popular food. The fish, mostly channel catfish and blue catfish, are found in most waterways in the region. The fish is typically breaded with cornmeal and fried. Catfish are easy to farm in warm climates, leading to inexpensive and safe food in local grocers. This has further increased its popularity in the U.S. as food.

A popular sport among some in these areas is noodling, which involves catching catfish using only one's bare hands by luring a catfish to bite the noodler's hand and then grabbing the fish's gills.

Trivia

- In the United States, June 25 is National Catfish Day.

Other catfish

- Iridescent Shark
  Channel catfish
  Redtail catfish

References

1. ^ J.E. Morris (October 1993). "*Pond Culture of Channel Catfish in the North Central Region*". North Central Regional Aquaculture Center. Retrieved on 2006-06-28.
2. ^ Grizzly Bear-Size Catfish Caught in Thailand. National Geographic News. Retrieved on 2006-07-14.

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Characidae

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Characiformes
Family: **Characidae**
Genera
Subfamily Aphyocharacinae
Aphyocharax
Subfamily Bryconinae
Chalceus
Subfamily Characidiinae
8 genera
Subfamily Characinae
Acanthocharax
Acestrocephalus
Charax
Cynopotamus
Galeocharax
Gnathocharax
Heterocharax
Hoplocharax
Priocharax
Roeboides
Thayeria
...
Subfamily Crenuchinae
Crenuchus
Poecilocharax
Subfamily Glandulocaudinae
16 genera
Subfamily Iguanodectinae
Iguanodectes
Piabucus
Subfamily Rhodasiinae
Carlana
Rhoadsia
Parastremma
Subfamily Serrasalminae
Catoprion
Colossoma
Metynnis

Myleus
Mylossoma
Pygocentrus
Serrasalmus
and 6 other genera

Subfamily Tetragonopterinae
Astyanax - Astynaxes
Byconamericus
Bryconops
Cheirodon
Gymnocorymbus
Hemibrycon
Hemigrammus
Hyphessobrycon
Inpaichthys
Megalamphodus
Moenkhausia
Oligosarcus
Paracheirodon
Rachoviscus
Tetragonopterus
Tyttobrycon
...

Subfamily - Incertae Sedis
(i.e., taxonomic placement at this level uncertain)
Boehlkea
Exodon
Hasemania
Nematobrycon
Oligosarcus
Petitella
Roeboexodon

The **Characidae** or **Characins** are a family of freshwater subtropical and tropical fish, belonging to the order Characiformes. They originate in the Americas from southwestern Texas and Mexico through Central and South America. They vary in length with the smallest growing to a maximum length of 0.5 in (13 mm).

To some extent the family has served as a junk-basket category in the past. More recent revision has moved many former members of the family into their own related but distinct families - the Pencilfishes of the genus *Nannostomus* are a typical example, having now been moved into the Lebiasinidae, the assorted predatory characins belonging to *Hoplias* and *Hoplerythrinus* have now been moved into the Erythrinidae, and the Sabre-Toothed Fishes of the genus *Hydrolycus* have been moved into the Cynodontidae. There is still much revision needed, but progress in this area is being maintained at a steady pace.

Among those fishes that remain in the Characidae for the time being are the tetras, comprising the very similar genera Hemigrammus and Hyphessobrycon, as well as a few related forms. These include the cave and neon tetras.

The larger piranhas were originally classified as belonging to the Characidae, but various revisions place them in their own related family, the Serrasalmidae. This reassignment has yet to enjoy universal acceptance, but is gaining in popularity among taxonomists working with these fishes. Given the current state of flux of the Characidae, a number of other changes will doubtless take place, reassigning once-familiar species to other families. Indeed, the entire phylogeny of the Ostariophysans (fishes possessing a Weberian apparatus) has yet to be conclusively settled, and until that phylogeny is settled, the opportunity for yet more upheavals within the taxonomy of the Characoid fishes is considerable.

Related Families

The fishes whose families and genera are listed below are a diverse selection of fishes that were formerly classified as members of the Characidae, but which were moved into separate families of their own during recent taxonomic revisions (post-1994).

Family Acestrorhynchidae - South American Pike Characins

- Acestrorhynchus - Pike Characins or Freshwater Barracudas

Family Alestiidae - African tetras

- Alestes (or Brycinus)
  Hydrocynus - African Tigerfishes
  Micralestes
  Phenacogrammus
  Rhabdalestes
- and 13 other genera

Family Anostomidae - Headstanders

- Anostomus
  Abramites
  Leporinus
  Rhytiodus
  Sartor
  Schizodon

Family Chilodontidae - Headstanders

- Chaenotropus
  Chilodus

Family Citharinidae

- Belonophago - African Pike Characins
  Citharidium
  Citharinops
  Citharinus
  Congocharax
  Distichodus
  Dundocharax
  Eugnaichthys
  Hemigrammocharax
  Hemistochodus

Ichthyborus
Mesoborus
Microstomatichthyoborus
Nannaethiops
Nannocharax
Neolebias
Paradistichodus
Paraphago - African Pike Characins
Phago - African Pike Characins
Xenocharax

Family Ctenoluciidae - Pike Characoids & Gar Characins

- Boulengerella
  Ctenolucius - Gar Characins

Family Curimatidae

- Curimata
  Curimatella
  Curimatopsis
  Cyphocharax
  Potamorhina
  Psectrogaster
  Pseudocurimata
  Steindachnerina

Family Cynodontidae - Dogtooth Characins

- Cynodon
  Gilbertolus
  Hydrolycus - Sabre Tooth Fishes
  Rhaphiodon
  Roestes

Family Erythrinidae - Pirate Fishes, Trahiras

- Erythrinus
  Hoplias - Trahiras or Destroyers
  Hoplerythrinus

Family Gasteropelecidae - Hatchet Fishes

- Carnegiella - Dwarf Hatchet Fishes
  Gasteropelecus - Hatchet Fishes
  Thoracocharax

Family Hemiodontidae

- Anodus
  Argonectes
  Bivibranchia
  Hemiodus
  Micromischodus

Family Hepsetidae - Kafue Pike (monotypic)

- *Hepsetus* - sole species *H. odoe*, Kafue Pike

Family Lebiasinidae - Pencil Fishes and allies

- Copeina
  Copella - Splashing Tetras
  Derhamia
  Lebiasina
  Piabucina
  Pyrrhulina
  Nannostomus - Pencil Fishes

Family Parodontidae

- Apareiodon
  Parodon
  Saccodon

Family Prochilodontidae

- Ichthyoelephas
  Prochilodus
  Semaprochilodus

References

- "Characidae." *ITIS Standard Report*. (Integrated Taxonomic Information System: National Museum of Natural History, Washington, D.C., 2004-10-13).
- "Family Characidae - Characins." *FishBase*. ed. Froese, R. and D. Pauly (08/2004),
- Géry, Jacques, *Characoids of the World*, ISBN 0-87666-458-3

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Tetras

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Characiformes
Family: **Characidae**
Genera
More than 150[1]

A **tetra** is any of a number of species of small South American freshwater fish belonging to the family Characidae and to its former subfamily Alestiidae ("African tetras"). The characidae are distingushed from other fishes by the presence of a small adipose fin between the dorsal and caudal fins. Many of these, such as the neon tetra, are brightly colored and easy to keep in captivity, and extremely popular for home aquaria.

Though the list below is sorted by common name, in a number of cases, the common name is applied to different species, depending on country and context. Since the aquarium trade may use a different name for the same specis, advanced aquarists tend to use scientific names for the less-common tetras.

Tetra species:

- Adonis tetra Lepidarchus adonis
- African long-finned tetra Brycinus longipinnis
- African moon tetra Bathyaethiops caudomaculatus
- Arnold's tetra Arnoldichthys spilopterus
- B-A tetra Hyphessobrycon anisitsi
- Banded tetra Astyanax aeneus
- Bandtail tetra Moenkhausia dichroura
- Barred glass tetra Phenagoniates macrolepis
- Bass tetra Hemigrammus rodwayi
- Beacon tetra Hemigrammus ocellifer
- Belgian flag tetra Hyphessobrycon heterorhabdus
- Black darter tetra Poecilocharax weitzmani
- Black morpho tetra Poecilocharax weitzmani
- Black neon tetra Hyphessobrycon herbertaxelrodi
- Black phantom tetra Hyphessobrycon megalopterus
- Black tetra Gymnocorymbus ternetzi
- Black tetra Hyphessobrycon herbertaxelrodi
- Black tetra Gymnocorymbus thayeri
- Black wedge tetra Hemigrammus pulcher

Blackband tetra Hyphessobrycon scholzei
Blackedge tetra Tyttocharax madeirae
Black-flag tetra Hyphessobrycon rosaceus
Black-jacket tetra Moenkhausia takasei
Blackline tetra Hyphessobrycon scholzei
Bleeding heart tetra Hyphessobrycon erythrostigma
Bleeding heart tetra Hyphessobrycon socolofi
Bleeding-heart tetra Hyphessobrycon erythrostigma
Blind tetra Stygichthys typhlops
Bloodfin tetra Aphyocharax anisitsi
Bloodfin tetra Aphyocharax alburnus
Blue tetra Mimagoniates microlepis
Blue tetra Tyttocharax madeirae
Blue tetra Boehlkea fredcochui
Brilliant rummynose tetra Hemigrammus bleheri
Bucktooth tetra Exodon paradoxus
Bucktoothed tetra Exodon paradoxus
Buenos Aires tetra Hyphessobrycon anisitsi
Butterfly tetra Gymnocorymbus ternetzi
Callistus tetra Hyphessobrycon eques
Calypso tetra Hyphessobrycon axelrodi
Cardinal tetra Paracheirodon axelrodi
Carlana tetra Carlana eigenmanni
Central tetra Astyanax aeneus
Cochu's blue tetra Boehlkea fredcochui
Coffee-bean tetra Hyphessobrycon takasei
Colcibolca tetra Astyanax nasutus
Congo tetra Phenacogrammus interruptus
Copper tetra Hasemania melanura
Costello tetra Hemigrammus hyanuary
Creek tetra Bryconamericus scleroparius
Creek tetra Bryconamericus terrabensis
Croaking tetra Mimagoniates inequalis
Croaking tetra Mimagoniates lateralis
Dawn tetra Hyphessobrycon eos
Dawn tetra Aphyocharax paraguayensis
Diamond tetra Moenkhausia pittieri
Discus tetra Brachychalcinus orbicularis
Disk tetra Brachychalcinus orbicularis
Disk tetra Myleus schomburgkii
Dragonfin tetra Pseudocorynopoma doriae
Ember tetra Hyphessobrycon amandae
Emperor tetra Nematobrycon palmeri
Emperor tetra Nematobrycon palmeri

False black tetra Gymnocorymbus thayeri
False neon tetra Paracheirodon simulans
False red nose tetra Petitella georgiae
False rummynose tetra Petitella georgiae
False rummy-nosed tetra Petitella georgiae
Featherfin tetra Hemigrammus unilineatus
Firehead tetra Hemigrammus bleheri
Flag tetra Hyphessobrycon heterorhabdus
Flame tail tetra Aphyocharax erythrurus
Flame tetra Hyphessobrycon flammeus
Flametail tetra Aphyocharax erythrurus
Garnet tetra Hemigrammus pulcher
Glass tetra Moenkhausia oligolepis
Glossy tetra Moenkhausia oligolepis
Glowlight tetra Hemigrammus erythrozonus
Gold tetra Hemigrammus rodwayi
Golden tetra Hemigrammus rodwayi
Goldencrown tetra Aphyocharax alburnus
Goldspotted tetra Hyphessobrycon griemi
Gold-tailed tetra Carlastyanax aurocaudatus
Green dwarf tetra Odontocharacidium aphanes
Green neon tetra Paracheirodon simulans
Green tetra Paracheirodon simulans
Griem's tetra Hyphessobrycon griemi
Head-and-taillight tetra Hemigrammus ocellifer
January tetra Hemigrammus hyanuary
Jellybean tetra Lepidarchus adonis
Jewel tetra Hyphessobrycon eques
Jumping tetra Hemibrycon tridens
Largespot tetra Astyanax orthodus
Lemon tetra Hyphessobrycon pulchripinnis
Longfin tetra Brycinus longipinnis
Long-finned glass tetra Xenagoniates bondi
Longjaw tetra Bramocharax bransfordii
Loreto tetra Hyphessobrycon loretoensis
Mayan tetra Hyphessobrycon compressus
Mexican Cave Tetra Astyanax mexicanus
Mexican tetra Astyanax mexicanus
Mexican tetra Astyanax fasciatus
Mimic scale-eating tetra Probolodus heterostomus
Mourning tetra Brycon pesu
Naked Tetra Gymnocharacinus bergii
Neon tetra Paracheirodon innesi
Neon tetra Paracheirodon simulans

Niger tetra Arnoldichthys spilopterus
Nurse tetra Brycinus nurse
Oneline tetra Nannaethiops unitaeniatus
One-line tetra Hemigrammus unilineatus
Orangefin tetra Bryconops affinis
Ornate tetra Hyphessobrycon bentosi
Panama tetra Hyphessobrycon panamensis
Peruvian tetra Hyphessobrycon peruvianus
Petticoat tetra Gymnocorymbus ternetzi
Phantom tetra Hyphessobrycon megalopterus
Pittier's tetra Moenkhausia pittieri
Pretty tetra Hemigrammus pulcher
Pristella tetra Pristella maxillaris
Pygmy tetra Odontostilbe dialeptura
Rainbow tetra Nematobrycon palmeri
Rainbow tetra Nematobrycon lacortei
Red eye tetra Moenkhausia sanctaefilomenae
Red phantom tetra Hyphessobrycon sweglesi
Red tetra Hyphessobrycon flammeus
Redeye tetra Moenkhausia sanctaefilomenae
Redeye tetra Moenkhausia oligolepis
Rednose tetra Hemigrammus rhodostomus
Red-nose tetra Hemigrammus bleheri
Rednosed tetra Hemigrammus rhodostomus
Redspotted tetra Copeina guttata
Rosy tetra Hyphessobrycon bentosi
Rosy tetra Hyphessobrycon rosaceus
Royal tetra Inpaichthys kerri
Ruby tetra Axelrodia riesei
Rummy-nose tetra Hemigrammus rhodostomus
Rummy-nose tetra Hemigrammus bleheri
Sailfin tetra Crenuchus spilurus
Savage tetra Hyphessobrycon savagei
Savanna tetra Hyphessobrycon stegemanni
Semaphore tetra Pterobrycon myrnae
Serpa tetra Hyphessobrycon eques
Serpae tetra Hyphessobrycon eques
Sharptooth tetra Micralestes acutidens
Silver tetra Gymnocorymbus thayeri
Silver tetra Ctenobrycon spilurus
Silver tetra Micralestes acutidens
Silvertip tetra Hasemania melanura
Silvertip tetra Hasemania nana
Silver-tipped tetra Hasemania nana

Splash tetra Copella arnoldi
Splashing tetra Copella arnoldi
Spotfin tetra Hyphessobrycon socolofi
Spottail tetra Moenkhausia dichroura
Spotted tetra Copella nattereri
Swegles's tetra Hyphessobrycon sweglesi
Tailspot tetra Bryconops caudomaculatus
Tetra von Rio Hyphessobrycon flammeus
Threeline tetra Neolebias trilineatus
Three-lined African tetra Neolebias trilineatus
Tiete tetra Brycon insignis
Tortuguero tetra Hyphessobrycon tortuguerae
Transparent tetra Charax gibbosus
True big-scale tetra Brycinus macrolepidotus
Uruguay tetra Cheirodon interruptus
White spot tetra Aphyocharax paraguayensis
X-ray tetra Pristella maxillaris
Yellow tetra Hyphessobrycon bifasciatus
Yellowtail tetra Alestopetersius caudalis
Yellow-tailed African tetra Alestopetersius caudalis

Footnotes

1. ^ As of 2003 the ITIS lists 164 genera of Characidae.

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Cichlidae

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: **Cichlidae**
Genera *See text.*

Cichlids (pronounced “sick-lids”) are fishes from the family **Cichlidae** in the order Perciformes. The family Cichlidae, a major family of perciform fish, is both large and diverse. Estimates of species range from 1300 to 1900, making it one of the three largest vertebrate families.[1][2] They span a wide range of body sizes, from so-called dwarf species as small as 2.5 cm in length (e.g. Neolamprologus multifasciatus) to much larger species approaching a metre in length (e.g. Boulengerochromis and Cichla). As a group the cichlids exhibit a similarly wide diversity of body shapes, ranging from strongly laterally compressed species (such as Altolamprologus, Pterophyllum, and Symphysodon) through to species that are cylindrical and highly elongate (such as Teleogramma, Teleocichla, Crenicichla, and Gobiocichla).[3] On the whole though, cichlids tend to be of medium size, round in shape and slightly laterally compressed, and generally very similar to the North American sunfishes in terms of morphology, behaviour, and ecology.[4]

Some species, particularly the tilapiines are important food fishes, while others are valued game fish (eg. Cichla species). Many species are also highly valued in the aquarium trade.[5][6] Cichlids are also the family of vertebrates with by far the highest number of endangered species, most of these being from among the haplochromine group.[7] Cichlids are particularly well known for having evolved rapidly into a large number of closely related but morphologically diverse species within in large lakes, particularly the African Rift Valley lakes of Tanganyika, , and Victoria, and Malawi.[8][9] Many cichlids that have been accidentally or deliberately released released into freshwaters outside of their natural range have become nuisance species, for example tilapia in the southern United States.[10]

Contents

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- 2 Range
- 3 Diet
- 4 Reproduction
- 5 Endangered cichlids
- 6 Hybrid cichlids
- 7 Cichlids as aquarium fish
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Characteristics of cichlids

Cichlids are members of a group of perciform fish known as the Labroidei alongside the wrasses Labridae, damselfish Pomacentridae, and surfperches Embiotocidae. This very large grouping shares a single key trait: the fusion of the lower pharyngeal bones into a single tooth-bearing structure. A complex set of muscles allows the upper and lower pharyngeal bones to be used as a second set of jaws for processing food, allowing a division of labour between the "true" jaws (mandibles) and the pharyngeal "jaws". Cichlids in particular have evolved to be very efficient feeders that are able to capture and process a very wide variety of food items and this is assumed to be one reason why they are so diverse (see section on diet below).[11]

The particular features of cichlids that distinguish them from the other Labroidei include:[12]

- A single nostril on each side of the forhead instead of two.
- No bony shelf below the orbit of the eye.
- The lateral line organ is divided into two sections, one on the upper half of the flank and a second along the midline of the flank from about halfway along the body to the base of the tail (except for genera Teleogramma and Gobiocichla).
- A distinctively shaped otolith.
- The small intestine leaves the stomach from its left side, not from its right side as in other Labroidei.
- Extensive brood care, with eggs and fry being guarded by one or both parents.

Range

Cichlids are mainly freshwater fish that are most diverse in Africa and South America. Substanial numbers are also found in Central America as far north as the Rio Grande in southern Texas, and Madagascar has its own distinctive fauna of cichlids phylogenetically only distantly related to those on the African mainland. Asia largely lacks endemic cichlids except in the Levant east to Iran, Sri Lanka, and southern India.. Europe, Australia, Antarctica, and most of North America do not have any native cichlids, although where environmental conditions are suitable, for example in Florida and northern Australia, feral populations of cichlids have become established as exotics. [13][14]

Cichlids are less commonly found in brackish and salt water habitats, though many species will tolerate brackish water for extended periods; *Cichlasoma urophthalmus*, for example, is equally at home in freshwater marshes and mangrove swamps, and can be found living and breeding in salt water environments such as the mangrove belts around barrier islands. [15] However, only a few cichlids are found primarily in brackish or salt water, most notably *Etroplus maculatus*, *Etroplus suratensis*, and *Sarotherodon melanotheron*. [16]

Diet

Cichlids are astonishingly diverse in terms of diet. Many are primarily herbivores feeding on algae (e.g. Petrochromis) and plants (e.g. Etroplus suratensis) and small animals, particularly invertebrates, are only a small part of their diet. Some cichlids are detritvores and eat all types of organic materia; among these species are the tilapias of the genera *Oreochromis*, *Sarotherodon*, and *Tilapia*.

Other cichlids are predatory and eat little if any plant matter. These include generalists that catch a variety of small animals including other fishes and insect larvae (e.g. Pterophyllum), as well as variety of specialists. Trematocranus is a specialised snail-eater, while Pungu maclareni feeds on sponges. A number of cichlids feed on other fish, either whole or in part. Crenicichla are stealth-predators that lunge at small fish that pass by their hiding places, while Cichla are open water pursuit predators that chase down their prey. Paedophagous cichlids such as Caprichromis species eat other species' eggs or young (in some cases ramming the heads of mouthbrooding species to force them to disgorge their young). Among the more unusual predators are *Plecodus straeleni* feeds on scales and fins ripped from other fishes, and *Nimbochromis livingstonii*, which lies on its side and plays dead, hoping to lure smaller fish close enough for it to snap them up.

Scientists believe it is this wide adaptability of feeding styles that has helped cichlids to inhabit such a wide range of habitats. It is largely the pharyngeal teeth (teeth in the throat) that allows the cichlid so many 'niche' feeding behaviors, i.e. the jaws may be used to hold or pick food, while the pharyngeal teeth are used to crush what was harvested.

Reproduction

All species show some form of parental care for both eggs and larvae, often extended to free-swimming young until they are several weeks or months old. The discus fish (Symphysodon species) are noted to feed their young with a secretion on the skin from slime glands. Other South American, some Central American and Madagascan cichlds have also been observed with fry feeding on their parents, but not to the extent of the discus. Parental care falls into one of three categories: mouthbrooders, substrate brooders, and delayed mouthbrooding where the eggs are laid in the open or in a cave, and subsequently brooded in the mouth(s) of the parents.

Endangered cichlids

Because of the introduced nile perch and water hyacinth, deforestation causing siltation of water, and overfishing, many species of Lake Victoria cichlids have been wiped out or drastically reduced in the wild. Thankfully, the myriad of satellite lakes surrounding Lake Victoria have not been affected, and harbor a vast array of similar species.

Hybrid cichlids

Some cichlids have been found to hybridise with closely related species quite readily, both in the wild and under artificial conditions.[17] This is not particularly unusual, having been observed among other groups of fishes, such as European cyprinids.[18] What is unusual is the extent to which cichlid hybrids have been put to commercial use, in particular as fast-growing food fish and as aquarium fish.[19][20]

Cichlids as aquarium fish

Cichlid keeping aquarists tend to divide cichlids into groups based on regions such as Central America, South America, Madagascar and India, Lake Tanganyika, Lake Malawi and Lake Victoria. It is noteworthy that most cichlids are not the most peaceful aquarium residents, though there are exceptions to this rule.

Cichlids from Lake Tanganyika were first collected by German hobbyists during the 1930's. However, it was during the 1970s and 80s that the cichlids from lakes Tanganyika and Malawi began to become popular aquarium fishes. This trend continues to the present unabated.

Perhaps the most commonly encountered species in retail aquariums is Pterophyllum scalare, known in the trade as the "angelfish". Other cichlids commonly stocked by retail aquaria include:

- Astronotus ocellatus (oscars)
  Cleithracara maronii (keyhole cichlids)
  Hemichromis sp. (Jewel cichlids)
  Labidochromis caeruleus (electric yellows)
  Mikrogeophagus ramirezi (blue rams)
  Pelvicachromis pulcher (kribensis)
  Sciaenochromis fryeri (electric blues)
  Symphysodon discus (discus)

Species of cichlid can be kept in aquariums with other fish, however, many cichlids are aggressively territorial or predatory towards smaller fish. Conversely, some cichlids, such as Apistogramma or Julidochromis spp., can be timid in the aquarium. In such cases the use of dither fish is recommended.

Genera

Source: Froese, R. and D. Pauly. Editors. 2006.FishBase. World Wide Web electronic publication. www.fishbase.org, version (03/2006). As of 2006, there are 223 genera.

Acarichthys Eigenmann 1912
Acaronia Myers 1940
Aequidens Eigenmann & Bray 1894
Alticorpus Stauffer & McKaye 1988
Altolamprologus Poll 1986
Amphilophus Agassiz, 1859
Anomalochromis Greenwood 1985
Apistogramma Regan 1913
Apistogrammoides Meinken 1965
Archocentrus Gill 1877
Aristochromis Trewavas, 1935
Astatoreochromis Pellegrin 1904
Astatotilapia Pellegrin 1904
Astronotus Swainson 1839
Aulonocara Regan 1922
Aulonocranus Regan 1920
Australoheros Rican & Kullander 2006
Baileychromis Poll 1986
Bathybates Boulenger 1898
Benitochromis Lamboj 2001
Benthochromis Poll 1986
Biotodoma Eigenmann & Kennedy 1903
Biotoecus Eigenmann & Kennedy 1903
Boulengerochromis Pellegrin 1904
Buccochromis Eccles & Trewavas 1989
Bujurquina Kullander 1986
Callochromis Regan 1920
Caprichromis Eccles & Trewavas 1989
Caquetaia Fowler 1945
Cardiopharynx Poll 1942
Chaetobranchopsis Steindachner, 1875
Chaetobranchus Heckel, 1840

Chalinochromis Poll 1974
Champsochromis Boulenger 1915
Cheilochromis Eccles & Trewavas 1989
Chetia Trewavas 1961
Chilochromis Boulenger 1902
Chilotilapia Boulenger 1908
Chromidotilapia Boulenger 1898
Cichla Bloch & Schneider 1801
Cichlasoma Swainson 1839
Cleithracara Kullander & Nijssen 1989
Copadichromis Eccles & Trewavas 1989
Corematodus Boulenger 1897
Crenicara Steindachner 1875
Crenicichla Heckel 1840
Ctenochromis Pfeffer 1893
Ctenopharynx Eccles & Trewavas 1989
Cunningtonia Boulenger 1906
Cyathochromis Trewavas 1935
Cyathopharynx Regan 1920
Cyclopharynx Poll 1948
Cynotilapia Regan 1922
Cyphotilapia Regan 1920
Cyprichromis Scheuermann 1977
Cyrtocara Boulenger 1902
Danakilia Thys van den Audenaerde 1969
Dicrossus Steindachner 1875
Dimidiochromis Eccles & Trewavas 1989
Diplotaxodon Trewavas 1935
Divandu Lamboj & Snoeks 2000
Docimodus Boulenger 1897
Eclectochromis Eccles & Trewavas 1989
Ectodus Boulenger 1898
Enterochromis Greenwood 1980
Eretmodus Boulenger 1898
Etia Schliewen & Stiassny 2003
Etroplus Cuvier 1830
Exochochromis Eccles & Trewavas

1989
Fossorochromis Eccles & Trewavas 1989
Gaurochromis Greenwood 1980
Genyochromis Trewavas 1935
Geophagus Heckel 1840
Gephyrochromis Boulenger 1901
Gnathochromis Poll 1981
Gobiocichla Kanazawa 1951
Grammatotria Boulenger 1899
Greenwoodochromis Poll 1983
Guianacara Kullander & Nijssen 1989
Gymnogeophagus Miranda Ribeiro 1918
Haplochromis Hilgendorf 1888
Haplotaxodon Boulenger 1906
Harpagochromis Greenwood 1980
Hemibates Regan 1920
Hemichromis Peters 1857
Hemitaeniochromis Eccles & Trewavas 1989
Hemitilapia Boulenger 1902
Herichthys Baird & Girard 1854
Herotilapia Pellegrin 1904
Heterochromis Regan 1922
Hoplarchus Kaup,1860
Hoplotilapia Hilgendorf 1888
Hypselecara Kullander 1986
Hypsophrys Agassiz 1859
Interochromis Yamaoka, Hori & Kuwamura 1988
Iodotropheus Oliver & Loiselle 1972
Iranocichla Coad 1982
Julidochromis Boulenger 1898
Katria Stiassny & Sparks 2006
Konia Trewavas 1972
Krobia Kullander & Nijssen 1989
Labeotropheus Ahl 1926
Labidochromis Trewavas 1935
Labrochromis Greenwood 1980
Laetacara Kullander 1986
Lamprologus Schilthuis 1891
Lepidiolamprologus Pellegrin 1904

Lestradea Poll 1943
Lethrinops Regan 1922
Lichnochromis Trewavas 1935
Limbochromis Greenwood 1987
Limnochromis Regan 1920
Limnotilapia Regan 1920
Lipochromis Greenwood 1980
Lithochromis Lippitsch & Seehausen 1998
Lobochilotes Boulenger 1915

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Jewel cichlid

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae
Genus: *Hemichromis*

Hemichromis is a genus of fish from the family Cichlidae, known in the aquarium trade as **Jewel cichlids**. **Jewel cichlids** are native to west Africa. Within west Africa *Hemichromis* species are found in creeks, streams, rivers and lakes with a variety of water qualities.

Jewel cichlids can reach lengths of 7-13 cm (6inch) in some species brightly coloured. Brighter body colouration is generally evident during breeding. Sexual dimorphism is limited, though male jewel cichlids are typically more brightly coloured and in some species have more pointed anal, ventral and dorsal fins. Like most cichlids, jewel cichlids have high developed brood care. Hemichromis species typically form monogamous breeding pairs and the female spawns on a flat surface such as a leaf or stone. Both parents guard the eggs, and participate in fry raising.

Species

- *Hemichromis angolensis* Steindachner, 1865
- *Hemichromis bimaculatus* Gill, 1862
- *Hemichromis cerasogaster* (Boulenger, 1899)
- *Hemichromis elongatus* (Guichenot, 1861)
- *Hemichromis exsul* (Trewavas, 1933)
- *Hemichromis fasciatus* Peters, 1857
- *Hemichromis frempongi* Loiselle, 1979
- *Hemichromis letourneuxi* Sauvage, 1880
- *Hemichromis lifalili* Loiselle, 1979
- *Hemichromis stellifer* Loiselle, 1979

Aquarium care

Jewel cichlids are neither suited to beginners, nor the usual community tank. Several young specimens may be kept in a spacious aquarium, with stones and wood for cover until a pair forms prior to breeding. Their innate aggression makes them good candidates for keeping in a monospecies aquarium.

Jewel cichlids are omnivorous and will eat both live foods and fish flakes.

References

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Labeotropheus

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae
Genus: ***Labeotropheus*** Ahl, 1926
Species See text.

Labeotropheus is a genus of cichlid fish endemic to Lake Malawi in eastern Africa. It includes at least 2 species, each with a number of subspecies or races. Further taxonomic work is required to determine how many species exist. These cichlids are popular ornamental fish and are ideally suited to the cichlid aquarium. Like many Malawi cichlids, Labeotropheus species are algal grazers.

Species

- Blue mbuna, Labeotropheus fuelleborni Ahl, 1926.
  Scrapermouth mbuna, Labeotropheus trewavasae Fryer, 1956.

In the aquarium

Like all cichlids from Lake Malawi these cichlids are best maintained in hard, alkaline water. Labeotropheus are best kept in aquariums with volumes greater than 120 l (31.5 gallon). The aquarium should be decorated with rocks, although caves can also be easily created from terracotta pots.

References

- "*Labeotropheus*". *FishBase*. Ed. Ranier Froese and Daniel Pauly. May 2006 version. N.p.: FishBase, 2006.

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Sciaenochromis

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae
Genus: ***Sciaenochromis*** Eccles & Trewavas, 1989
Species See text.

Sciaenochromis is a genus of cichlid fish endemic to Lake Malawi in east Africa. It includes at least 4 species. The species are popular in the aquarium hobby most notably S. fryeri, known in the aquarium trade as the electric blue. All Sciaenochromis are piscivores (fish-eaters) and prey mainly upon the fry of mbuna and other Haplochromine cichlids.

Species

- Sciaenochromis ahli (Trewavas, 1935).
  Sciaenochromis benthicola Konings, 1993.
  Sciaenochromis fryeri Konings, 1993.
  Sciaenochromis psammophilus Konings, 1993.

In the aquarium

Like all cichlids from Lake Malawi these cichlids are best maintained in hard, alkaline water. Sciaenochromis are best kept in aquariums with volumes greater than 120 l (31.5 gallon).

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Steatocranus

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae
Genus: ***Steatocranus***
Species See text.

Steatocranus (Boulenger, 1899) is a small genus of rheophilic cichlid fish endemic to the Congo River, although one species, Steatocranus irevinei, occurs in west Africa. The genus currently includes 9 species, all of which have relatively reduced swim bladder function. The name *Steatocranus* refers to the fatty deposit on the forehead of most species. Two species, *Steatocranus casuarius* (also known as the lionhead, blockhead or humphead) and *Steatocranus tinanti* are relatively common in the aquarium trade. As for other cichlids brood care is highly developed and both sexes are involved in raising the young. All *Steatocranus* species are secretive cave spawners and form monogamous pairs for breeding. The female is more actively involved in fry raising, while the male is primarily concerned with territorial defence.

Species

- *Steatocranus bleheri* Meyer, 1993
- *Steatocranus casuarius* Poll, 1939
- *Steatocranus gibbiceps* Boulenger, 1899
- *Steatocranus glaber* Roberts & Stewart, 1976
- *Steatocranus irvinei* (Trewavas, 1943)
- *Steatocranus mpozoensis* Roberts & Stewart, 1976
- *Steatocranus rouxi* (Pellegrin, 1928)
- *Steatocranus sp red eyes*
- *Steatocranus tinanti* (Poll, 1939)
- *Steatocranus ubanguiensis* Roberts & Stewart, 1976

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Corydoras

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Siluriformes
Family: Callichthyidae
Genus: ***Corydoras***
Type Species: *Corydoras geoffroy* Lacepède, 1803
Species

Corydoras acutus (Blacktop corydoras)
Corydoras adolfoi (Adolf's catfish)
Corydoras aeneus (Bronze corydoras)
Corydoras ambiacus (Spotted corydoras)
Corydoras atropersonatus
Corydoras axelrodi (Pink corydoras)
Corydoras bondi (Blackstripe corydoras)
Corydoras caudimaculatus (Tailspot corydoras)
Corydoras cochui (Barredtail corydoras)
Corydoras elegans (Elegant corydoras)
Corydoras ehrhardti
Corydoras evelynae
Corydoras geoffroy
Corydoras guapore (Guapore corydoras)
Corydoras habrosus (Salt and petter catfish)
Corydoras hastatus (Dwarf corydoras)
Corydoras haraldschultzi (Mosaic corydoras)
Corydoras latus
Corydoras leucomelas (False spotted catfish)
Corydoras loxozonus
Corydoras macropterus (Sailfin corydoras)
Corydoras melanotaenia (Green gold catfish)
Corydoras melanistius (Bluespotted corydoras)
Corydoras melini (Bandit corydoras)
Corydoras metae (Masked corydoras)
Corydoras nanus
Corydoras narcissus
Corydoras nattereri (Blue corydoras)
Corydoras ornatus
Corydoras osteocarus
Corydoras paleatus (Peppered cory)
Corydoras pastazensis (Pastaza corydoras)
Corydoras panda (Panda corydoras)
Corydoras polystictus
Corydoras prionotos
Corydoras pygmaeus (Pygmy corydoras)
Corydoras reticulatus (Reticulated corydoras)
Corydoras schwartzi (Schwartz's catfish)
Corydoras semiaquilus
Corydoras septentrionalis
Corydoras simulatus
Corydoras sodalis (False network catfish)
Corydoras sterbai(Sterba's cory)
Corydoras sychri (Sychr's catfish)

Corydoras trilineatus (Threestripe corydoras)
Corydoras undulatus
Corydoras xinguensis (Xingu corydoras)

Members of the South American ***Corydoras*** genus are freshwater temperate and tropical catfish in the armored catfish family, and are commonly referred to as **cory catfish**, **cory cats**, or simply **corys**. The type species for this genus is Corydoras geoffroy. The name Corydoras is derived from the Greek *kory* (helmet) and *doras* (skin).

Corydoras is a very large genus with over 180 described species. In addition, many variants exist. Several hundred *Corydoras* species are not yet classified, but kept by aquarists. These species are given C-Numbers, originally devised by Hans-Georg Evers for the German fishkeeping magazine DATZ in 1993. As of 2006, are 153 C-numbers assigned, of which 32 have subsequently been assigned appropriate scientific names.

Corydoras are native to slow-moving and almost still (but seldom stagnant) streams and small rivers of South America where the water is shallow and very clear. The preferred bottom seems to be sand or sand mixed with mud, sometimes covered with detritus or dead leaves. The banks and sides of the streams are covered with a dense growth of plants, and this is where the corys are found. They inhabit a wide variety of water types but tend toward soft, neutral to slightly acidic or slightly alkaline pH and 5-10 degrees of hardness. They can tolerate only a small amount of salt (some species tolerate none at all) and do not inhabit environments with tidal influences. Many species are found in schools or aggregations of hundreds or even thousands of individuals, usually of a single species, but occasionally with other species mixed in.

Their main food is bottom-dwelling insects and insect larvae and various worms, as well as some vegetable matter. Although no corys are piscivorous, they will eat flesh from dead fishes. Their feeding method is to search the bottom with their sensory barbels and suck up food items with their mouth, often burying their snout up to their eyes, one of the reasons a soft sand substrate is preferable.

In the aquarium

Corys are popular aquarium fish and typically measure around four to seven centimetres in length. They are well suited to tropical freshwater community aquariums, as they get along well with other species and are not at all aggressive. Corys are shy fish and it is recommended to keep them in groups of at least six as most species seem to form shoals in the aquaria (e.g. Paxton 1997). Corys are mostly bottom feeders, so they should be offered flake foods (which do sink), sinking pellets, and supplements of live and frozen foods, but care should be taken to prevent all the food from being eaten by the faster-moving fish at the higher levels of the tank.

Most corys prefer soft, acidic water. However, they can tolerate a wide range of water conditions. They do not do well in fish tanks with high nitrate levels. This ion leads to the infection of the barbels, which will shorten and become useless. The barbels may also be affected by constant contact with a sharp substrate. These are easy fish to keep, being peaceful, small, hardy, active, and entertaining. Occasionally they will dart to the surface, sticking their snout above the water for an instant, appearing to take a "breath" of fresh air. This behavior is perfectly normal and is not an indication that anything is wrong with the fish.

Where investigated *Corydoras* sp. have been shown to be diurnal and crepuscular rather than nocturnal and activity can even peak at twilight (Paxton 1997). *Corydoras* are very good choices for a community aquarium, and are widely kept throughout the world. Their longevity in the aquarium is noteworthy; *C. aeneus* is said to have lived 27 years in captivity and 20 years is not too uncommon.

References

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Danios

Danionins
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Subfamily: Danioninae
Genus: *Chela*, *Danio*, *Danionella*, *Devario*, *Esomus*, *Inlecypris*, *Microrasbora*, *Parachela*, *Sundadanio*.

Species of Danionin
Danio
Danio albolineatus
Danio abolineatus var pulcher
Danio abolineatus var tweediei
Danio choprae
Danio dangila
Danio feegradei
Danio kerri
Danio kyathit var spotted
Danio kyathit var striped
Danio meghalayensis
Danio nigrofasciatus
Danio roseus
Danio rerio
Danio rerio var frankei
Danio sp "Hikari"
Danio sp aff kyathit
Danio sp "KP01"
Danio sp "TW01"
Danio sp "TW02"
Danio sp "TW03"
Danionella
Danionella mirifica
Danionella translucifida
Devario
Devario acrostomus
Devario acuticephala
Devario aequipinnatus
Devario affinis
Devario annandalei

Devario apogon
Devario apopyris
Devario assamensis
Devario browni
Devario chrysotaeniatus
Devario devario
Devario fangfangae
Devario fraseri
Devario gibber
Devario horai
Devario interruptus
Devario kakhienensis
Devario laoensis
Devario leptos
Devario manipurensis
Devario Maetangensis
Devario malabaricus
Devario naganensis
Devario neilgherriensis
Devario pathirana
Devario peninsulae
Devario quangbinhensis
Devario regina
Devario salmonata
Devario shanensis
Devario sondhii
Devario spinosus
Devario strigillifer
Devario suvatti
Devario yuensis
Devario sp "Broken Line"
Chela
Chela cachius
Chela caeruleostigmata
Chela dadiburjori
Chela fasciata
Chela laubuca
Chela maassi
Esomus
Esomus ahli
Esomus altus
Esomus barbatus
Esomus caudiocellatus
Esomus danricus

Esomus lineatus
Esomus longimanus
Esomus malabaricus
Esomus malayensis
Esomus manipurensis
Esomus metallicus
Esomus thermoicos
Inlecypris
Inlecypris jayarami
Inlecypris auropurpurea
Microrasbora
Microrasbora erythromicron
Microrasbora gatesi
Microrasbora kubotai
Microrasbora nana
Microrasbora rubescens
Microrasbora sp "galaxy"
Parachela
Parachela cyanea
Parachela hypophthalmus
Parachela ingerkongi
Parachela maculicauda
Parachela oxygastroides - Glass Fish
Parachela siamensis
Parachela williaminae
Sundadanio
Sundadanio axelrodi
Tanichthys (not strictly a danionin)
Tanichthys albonubes
Tanichthys micagemmae

The **Danionins** are small minnow-type fish belonging to the family Cyprinidae, mostly in the genera ***Danio*** and ***Devario*** (Some species were previously in the genus formerly known as ***Brachydanio***). They are native to the fresh waters of southeast Asia, but many species are brightly coloured, and are available as aquarium fish worldwide. *Danios* tend to have horizontal stripes and long barbels, *Devarios* tend to have vertical bars and short rudimentary barbels, if barbels are present at all. A number of the species have only been recently discovered, in remote inland areas of Laos and Myanmar and do not yet have scientific names. The phrase **Danionins** is used to describe all the Danio species which include fish within the genera *Danio*, *Devario*, *Chela*, *Esomus*, *Inlecypris*, *Parachela* and probably also *Danionella*, *Microrasbora* and *Sundadanio*. *Tanichthys* is often regarded as a Danionin however there is no scientific basis for this. The

Danionins can be classed as a subfamily *Danioninae* which is increasingly gaining credibility as a distinct subfamily from Rasboriniae within the Cyprinidae family.

All Danionins are egg scatters and breed in the rainy season in the wild. They are generally active swimmers occupying the top half of a tank and are carnivores, living on insects and small crustaceans in the wild, although they will eat just about any type of aquarium food. They will not, however, generally eat plants or algae.

Although boisterous and liable to chase each other and other fish, they are good community fish and will not generally attack each other or other fish, although they occasionally nip fins, more by accident than design and will, like most fish, eat eggs and any fish small enough to fit into their mouths.

They are best kept in a tank long enough for their active swimming, preferably with a current from a power filter (or at least airstone) as they often live in fast flowing streams in the wild. Generally this also results in them being sub tropical with temperatures of 20 to 22 degrees Celsius (low seventies degrees Fahrenheit) often being fine, however they are good jumpers and a tight fitting lid is recommended.

Contents

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- 2 Species, listed in order of scientific name, categorised by genus
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    - 2.4 Tanichthys
    - 2.5 Esomus
    - 2.6 Chela
    - 2.7 Parachela
    - 2.8 Inlecypris
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        - 2.9.2 Microrasbora
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- 4 See also

Common names given to Danionin species

Since 2004 many new Danionins have been discovered which do not yet have scientific names and many other species, previously known only to the scientific fraternity have become available in Aquarist Shops. This has predictably led to total confusion as to the naming of some fish, with some species having up to five different common names in use and some common names bein used for up to four different species. As a result all Danionin common names known to be in use are listed on a separate page:

Species, listed in order of scientific name, categorised by genus

Danios

The species remaining in the *Danio* genus comprise most of the Danionins familiar to aquarists. They have two pairs of long barbels and are generally characterised by horizontal stripes (with the exception of the Glowlight Danio and Black Barred Danio which have vertical bars. In size they range from 4 cm/ 1.75 in) to 15 cm/ 6 in).

Frequently used common names are given for reference, however if the common name you are looking for does not appear, click on it on the section above for more details

- Danio albolineatus - Pearl Danio -(6 cm/ 2.5 in)
  Danio abolineatus var pulcher - Blue-Redstripe Danio - (5 cm/ 2 in)
  Danio abolineatus var tweediei - Kedah Danio - (5 cm/ 2 in)
  Danio choprae - Glowlight Danio - (4 cm/ 1.25 in)
  Danio dangila - Moustached danio - (15 cm/ 6 in)
  Danio feegradei - Yoma Danio - (8 cm/ 3 in)
  Danio kerri - Blue Danio - (5 cm/ 2 in)
  Danio kyathit var spotted - Ocelot Danio - (6 cm/ 2.5 in)
  Danio kyathit var striped - Orange Finned Zebra Danio - (6 cm/ 2.5 in)
  Danio meghalayensis - Meghalaya Danio - (9 cm/ 4 in)
  Danio nigrofasciatus - Spotted Danio - (4 cm/ 1.25 in)
  Danio roseus - Rose Danio - (6cm/ 2.5 in)
  Danio rerio - Zebra danio -(6 cm/ 2.5 in)
  Danio rerio var frankei - Leopard Danio -(6 cm/ 2.5 in)
  Danio sp "Hikari" - Hikari Danio - (5 cm/ 2 in)
  Danio sp aff kyathit - Redfin Danio - (6 cm/ 2.5 in)
  Danio sp "KP01" - Burma Zebra Danio - (9 cm/ 3 in)
  Danio sp "TW01" - Black Barred Danio - (8 cm/ 3 in)
  Danio sp "TW02" - Burma Danio - (4 cm/ 1.25 in)
  Danio sp "TW03" - Panther Danio - (5 cm/ 2 in)

Devarios

The *Devarios* comprise some Danionins familiar to aquarists. Generally (but not all) larger fish than *Danios*, they have short barbels (if present at all) and generally have deeper bodies than *Danios* with species having vertical stripes present (as well as horizontal). In size they range from 5 cm/ 2 in) to 15 cm/ 6 in).

- Devario aequipinnatus - Giant Danio - (15 cm/ 6 in)
- Devario affinis - False Giant Danio - (15 cm/ 6 in)
- Devario apogon
- Devario assamensis - Red Mirik Danio - (15 cm/ 6 in)
- Devario annandalei - Annandale's Giant Danio - (15 cm/ 6 in)
- Devario browni - Browns Danio (8 cm/ 3.5 in)
- Devario chrysotaeniatus Gold Striped Danio - (8 cm/ 3 in)
- Devario devario - Bengal Danio or Sind Danio (15 cm/ 6 in)
- Devario interruptus
- Devario Maetangensis - Fire Bar Danio - (7 cm/ 2.75 in)
- Devario laoensis - Laos Giant Danio (8 cm/ 3 in)
- Devario malabaricus - Malabar Danio - (15 cm/ 6 in)
- Devario pathirana - Barred Danio - (6 cm/ 2 in)
- Devario regina - Queen Danio - (13 cm/ 5 in)
- Devario shanensis - Shan Danio (7 cm/ 2.75 in)
- Devario strigillifer
- Devario sp "Broken Line" - Blue Moon Danio - (15 cm/ 6 in)

Little known Devarios

Little is known about the following *Devario* species, however there is some information about them at the Fishbase Devario index(Fishbase: Ed. Ranier Froese and Daniel Pauly. July 2005 version)

- Devario acrostomus
- Devario acuticephala - Sharp Headed Danio
- Devario apopyris
- Devario fangfangae
- Devario fraseri - Fraser's Danio
- Devario gibber
- Devario horai
- Devario kakhienensis - Kakhyen Hills Danio
- Devario leptos
- Devario manipurensis
- Devario naganensis - Naga Hills Danio

- Devario neilgherriensis - Neilgherry Hills Giant Danio
- Devario peninsulae
- Devario quangbinhensis
- Devario salmonata
- Devario sondhii - Sondhi's Danio
- Devario spinosus
- Devario suvatti
- Devario yuensis

Tanichthys

Not strictly speaking a Danionin but widely regarded as one, this genus has its own Wikipedia page. Click on *Tanichthys* for more information about these fish.

- Tanichthys albonubes - White Cloud Mountain Minnow - (6 cm/ 2 in)
- Tanichthys micagemmae - Vietnamese Cardinal Minnow - (5 cm/ 1.75 in)

Esomus

A genus comprising the **Flying Barbs**, they are closely related to the *Danio* genus and are distinctive for their extremely long barbels.

- Esomus ahli
- Esomus altus
- Esomus barbatus - South Indian Flying Barb
- Esomus caudiocellatus
- Esomus danricus - Indian Flying Barb
- Esomus lineatus - Striped Flying Barb
- Esomus longimanus - Mekong Flying Barb
- Esomus malabaricus
- Esomus malayensis - Malayan Flying Barb
- Esomus manipurensis
- Esomus metallicus - Striped Flying Barb
- Esomus thermoicos

Chela

A closly related genus to *Devario*

- Chela cachius - Neon Hatchet Fish
  Chela caeruleostigmata - Leaping Barb
  Chela dadiburjori - Dadio
  Chela fasciata
  Chela laubuca - Indian Glass Barb
  Chela maassi

Parachela

Closely related to *Chela* and *Devario*

- Parachela cyanea
  Parachela hypophthalmus
  Parachela ingerkongi
  Parachela maculicauda
  Parachela oxygastroides - Glass Fish
  Parachela siamensis
  Parachela williaminae

Inlecypris

A genus closely related to *Devario* comprising two smallish barred fish from Lake Inle in Myanmar.

- *Inlecypris jayarami*
  Inlecypris auropurpurea

Other Danionin genera

The following genera of tiny fish are thought to be Danionins closely related to *Danio* and *Esomus*, but too little is known about them to confirm this.

Danionella

A genus comprising two tiny, recently discovered fish, *Danionella translucida* is the smallest known freshwater fish

- Danionella mirifica (1.4 cm/ 0.75 in)
  Danionella translucida (1.1 cm/ 0.5 in)
  Several other as yet unnamed Danionella species have very recently been discovered.

Microrasbora

The genus name means "small Rasbora", however these fish appear to be more closely related to the danios than *rasboras*. There has been speculation that *Microrasbora erythromicron* may be transferred to the *Danio* genus but this now seems unlikely

- Microrasbora erythromicron
  Microrasbora gatesi
  Microrasbora kubotai
  Microrasbora nana
  Microrasbora rubescens
  Microrasbora sp "galaxy" - Galaxy Rasbora

Sundadanio

A genus with only one fish within, the genus was created after the axelrodi species was transferred from the Rasbora. Axelrodi resembles a tiny Rasbora

- *Sundadanio axelrodi*

Danionins renamed or wrongly identified

- The following genera that previously described certain danionins are no longer valid:
    - *Allodanio*
    - *Brachydanio*
    - *Danioides*
    - *Daniops*
    - *Eustira*
    - *Parabarilius*
    - *Paradanio*
    - *Rambaibarnia*

- All *Devario* species were formerly in the genus *Danio*. In addition *Devario acuticephala*, *Devario shanensis* and *Devario sondhii* were also regarded at one time as being in the former genus *Brachydanio*

- Certain fish were formerly described within Danionin genera and subsequently moved to their correct genus. Where such fish were moved to the genus: Achielognargus, Acanthorhodeus, Barilius, Opsarius, Oxygaster, Paralaubuca, Rhodeus, Salmostoma & Securicula, such fish are not now deemed to be Danionins.

- *Allodanio ponticulus*, now renamed *Barilius ponticulus*

- *Aphyocypris pooni*, "Garnet", now deemed a synonym of *Tanichthys albonubes* (White Cloud Mountain Minnow)

- Brachydanio acuticephala, now renamed Devario acuticephala
  Brachydanio albolineatus, , now renamed Danio albolineatus (Pearl Danio)

Brachydanio choprae, now renamed Danio choprai (Glowlight Danio)
Brachydanio frankei, now deemed a subspecies of Danio rerio (Danio rerio var frankei)
Brachydanio jayarami, now renamed Inlecypris jayarami
Brachydanio kerri, now renamed Danio kerri (Blue danio)
Brachydanio nigrofasciatus, now renamed Danio nigrofasciatus (Spotted Danio),
Brachydanio pulcher, now deemed a subspecies of Danio albolineatus (Danio abolineatus var pulcher)
Brachydanio rerio, now renamed Danio rerio (Zebra Danio),
Brachydanio shanensis, now renamed Devario shanensis
Brachydanio sondhii, now renamed Devario sondhii
Brachydanio tweediei, now deemed a subspecies of Danio albolineatus (Danio abolineatus var tweediei)

- Danio aeqipinnulus, now deemed a synonym of Devario aequipinnatus (Giant Danio)
Danio albolineata, now deemed a synonym of Danio albolineatus (Pearl Danio)
Danio analipunctatus, now deemed a synonym of Danio nigrofasciatus (Spotted Danio)
Danio deyi, now deemed a synonym of Danio dangila (Moustached Danio)
Danio interrupta, now deemed a synonym of Devario interruptus
Danio jayarami, now renamed Inlecypris jayarami
Danio lineatus, now deemed a synonym of Danio rerio (Zebra Danio)
Danio lineolatus, now deemed a synonym of Devario aequipinnatus (Giant Danio)
Danio menglaensis, now renamed Opsarius koratensis
Danio menoni, now renamed Chela laubuca
Danio micronema, now deemed a synonym of Devario malabaricus (Malabar Danio)
Danio monshiensis, now renamed Barilius monshiensis,
Danio ponticulus, now renamed Barilius ponticulus
Danio rheinarddti, now renamed Rhodeus rheinardti
Danio salmonatus, now deemed a synonym of Devario salmonata
Danio stoliczae, now deemed a synonym of Danio albolineatus (Pearl Danio)

- *Daniops myersi*, now renamed *Devario laoensis*

- Devario chankaeinsis, Khanka Spiny Bitterling, now renamed Achielognargus chankaeinsis
  Devario asmussii Russian Bitterling, now renamed Acanthorhodeus Asmussii

- Chela anastoma, now deemed a synonym of Chela cachius
  Chela anomalurus, now renamed Oxygaster anomalura
  Chela argentea, now deemed a synonym of Salmostoma acinaces
  Chela atpar, now deemed a synonym of Chela cachius
  Chela bacaila, now renamed Salmostoma bacaila
  Chela barroni, now renamed Paralaubuca barroni
  Chela boopis, now deemed a synonym of Salmostoma boopis
  Chela clupeoides, now deemed a synonym of Salmostoma balokee
  Chela dadidurjori, now deemed a synonym of Chela dadiburjori
  Chela dadyburjori, now deemed a synonym of Chela dadiburjori
  Chela dadydurjori, now deemed a synonym of Chela dadiburjori
  Chela diffusa, now deemed a synonym of Salmostoma acinaces
  Chela fasciatus, now deemed a synonym of Chela fasciata
  Chela horai, now renamed Salmostoma horai
  Chela hypophthalmus, now renamed Chela hypophthalmus
  Chela gora, now renamed Securicula gora
  Chela johorensis, now deemed a synonym of Parachela oxygastroides
  Chela maassi, now deemed a synonym of Chela maasi
  Chela maculicauda, now renamed Parachela maculicauda
  Chela megalolepsis, now deemed a synonym of Parachela oxygastroides
  Chela mouhoti, now deemed a synonym of Chela caeruleostigmata
  Chela nicholsi, now deemed a synonym of Paralaubuca sinensis
  Chela oxygaster, now deemed a synonym of Oxygaster anomalura
  Chela oxygastroides', now deemed a synonym of Parachela oxygastroides
  Chela panjabensis, now deemed a synonym of Salmostoma punjabensis

Chela phulo, now renamed Salmostoma phulo
Chela punjabensis, now renamed Salmostoma punjabensis
Chela pointoni, now renamed Oxygaster pointoni
Chela quangbinhensis, now renamed Devario quangbinhensis
Chela sardinella, now renamed Salmostoma sardinella
Chela siamensis, now renamed Parachela siamensis
Chela sladoni, now renamed Salmostoma sladoni
Chela stigmabrachium, now renamed Paralaubuca stigmabrachium
Chela teekanee, now deemed a synonym of Salmostoma balokee
Chela untrahi, now renamed Salmostoma untrahi

- *Inlecypris auropurpureus*, now renamed *Inlecypris auropurpurea*

See also

- Carp - fellow cyprinids

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Gobiidae

Gobies

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: **Gobiidae**
Subfamilies: *Amblyopinae, Gobiinae, Gobionellinae, Oxudercinae, Sicydiinae*

The **gobies** form the family **Gobiidae**, which is one of the largest families of fish, with more than 2,000 species in more than 200 genera.[1] Most are relatively small, typically less than 10 cm (4 in) in length. Gobies include some of the smallest vertebrates in the world, like species of the genera Trimmaton and Pandaka, which are under 1 cm (3/8 in) long when fully grown. There are some large gobies, such as some species of the genera Gobioides or Periophthalmodon, that can reach over 30 cm (1 ft) in length, but that is exceptional. Although few are important as food for humans, they are of great significance as prey species for commercially important fish like cod, haddock, sea bass, and flatfish. Several gobies are also of interest as aquarium fish, such as the bumblebee gobies of the genus *Brachygobius*.

The most distinctive aspect of goby morphology are the fused pelvic fins that form a disc-shaped sucker. This sucker is functionally analogous to the dorsal fin sucker possessed by the remoras or the pelvic fin sucker of the lumpsuckers, but is anatomically distinct: these similarities are the product of convergent evolution. Gobies can often be seen using the sucker to adhere to rocks and corals, and in aquaria they will happily stick to glass walls of the tank as well.

Gobies are primarily fish of shallow marine habitats including tide pools, coral reefs, and seagrass meadows; they are also very numerous in brackish water and estuarine habitats including the lower reaches of rivers, mangrove swamps, and salt marshes. A small number of gobies (unknown exactly, but in the low hundreds) are also fully adapted to freshwater environments. These include the Asian river gobies (Rhinogobius spp.), the Australian desert goby (Chlamydogobius eremius), and the European freshwater goby Padogobius bonelli.

Contents

- 1 Mudskippers
- 2 Symbiosis
- 3 In aquaria
- 4 See also
- 5 References

Mudskippers

Mudskippers are highly specialised members of the family, usually ascribed to the subfamily Oxudercinae. They are able to survive for extended periods on land through a combination of behavioural and physiological adaptations, including pectoral fins that act as simple legs; the ability to breathe through their skins (like frogs); and the digging of damp burrows to avoid drying out. Mudskippers live in tidal areas, particular on mudflats and in mangrove forests, and are only found in tropical and subtropical regions.

Symbiosis

Gobies sometimes form symbiotic relationships with other species. [2] Some goby species live in symbiosis with burrowing shrimps. The shrimp maintains a burrow in the sand in which both the shrimp and the goby fish live. The shrimp has poor eyesight compared to the goby, but if it sees or feels the goby suddenly swim into the burrow, it will follow. The goby and shrimp keep in contact with each other, the shrimp using its antennae, and the goby flicking the shrimp with its tail when alarmed. These gobies are thus sometimes known as **watchman gobies**. Each party gains from this relationship: the shrimp gets a warning of approaching danger, and the goby gets a safe home and a place to lay its eggs.

Another example of symbiosis is demonstrated by the neon gobies (Gobiosoma spp.). These gobies are known as "cleaner gobies", and remove parasites from the skin, fins, mouth, and gills of a wide variety of large fish. The most remarkable aspect of this symbiosis is that many of the fish that visit the cleaner gobies' cleaning station would otherwise treat such small fish as food (for example groupers and snappers). Again, this is a relationship where both parties gain: the gobies get a continual supply of food as big fish visit their cleaning stations, and the big fish leave the cleaning station healthier than they were when they arrived.

In aquaria

Several species of goby are kept in aquaria.[3] The bumblebee gobies, genus Brachygobius are perhaps the most widely traded examples, being small, colourful, and easy to care for. They need tropical, hard and alkaline freshwater or slightly brackish conditions to do well. Gobies are generally peaceful towards their tankmates though territorial among themselves. Since most are small and few are predatory towards other fishes, they usually make good community fishes. Typically, the main problem with gobies is feeding them: with a few exceptions, the small species kept in aquaria prefer live or frozen foods rather than flake, and they are not very good at competing with active species such as cichlids. It is often recommended that gobies be kept on their own or with peaceful surface dwelling species such as halfbeaks and guppies.

See also

- Sleeper gobies are a closely-related family (Eleotridae) that lack the fused pelvic fin sucker typical of most gobies but are otherwise very similar in size, shape, and ecology.
- Blennies are a group of shallow water marine fish often confused with gobies.
- Dragonets are superficially similar to gobies and sometimes confused with them.

References

1. ^ "Gobiidae". *FishBase*. Ed. Ranier Froese and Daniel Pauly. January 2006 version. N.p.: FishBase, 2006.
2. ^ *G. S. Helfman, B. B. Colette & D. E. Facey (1997). "Chapter 21: Fishes as social animals", The Diversity of Fishes. Blackwell. ISBN 0-86542-256-7.*
3. ^ *Frank Schäfer (2005). Brackish-Water Fishes. Aqualog. ISBN 3-936027-82-X (English), ISBN 3-936027-81-1 (German).*

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Osphronemidae

Gouramies

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Suborder: Anabantoidei
Family: **Osphronemidae**
Subfamilies

Belontiinae
Macropodinae
Osphroneminae
Trichogastrinae
See text for genera and species.

The **gouramis** or **gouramies** are a family, **Osphronemidae**, of freshwater perciform fishes. The fish are native to Asia, from Pakistan and India to the Malay Archipelago and north-easterly towards Korea.

Many gouramies have an elongated ray at the front of their pelvic fins. Many species show parental care: some are mouthbrooders, and others, like the Siamese fighting fish (*Betta splendens*), build bubble nests. Currently, about 90 species are recognised, placed in 4 subfamilies and about 13 genera.

The name **Polyacanthidae** has also been used for this family. Some fish now classified as gouramies were previously placed in family Anabantidae. The subfamily **Belontiinae** was recently demoted from the family **Belontiidae**. As labyrinth fishes, gouramis have a lung-like labyrinth organ that allows them to gulp air and use atmospheric oxygen. This organ is a vital innovation for fishes that often inhabit warm, shallow, oxygen-poor water.

Contents

- 1 Species
- 2 References

Species

There are about 96 species in 15 genera.

- Subfamily Belontiinae (combtail gouramis)
    - Genus *Belontia*
        - Malay combtail, Belontia hasselti (Cuvier, 1831).
          Ceylonese combtail, Belontia signata (Günther, 1861).
- Subfamily Macropodinae (paradise fish)
    - Genus *Betta*
        - Akar betta, Betta akarensis Regan, 1910.
          Betta albimarginata Kottelat & Ng, 1994.
          Giant betta, Betta anabatoides Bleeker, 1851.
          Betta antoni Tan & Ng, 2006.
          Betta balunga Herre, 1940.
          Slim betta, Betta bellica Sauvage, 1884.
          Betta breviobesus Tan & Kottelat, 1998.
          Betta brownorum Witte & Schmidt, 1992.
          Betta burdigala Kottelat & Ng, 1994.
          Betta channoides Kottelat & Ng, 1994.
          Betta chini Ng, 1993.
          Betta chloropharynx Kottelat & Ng, 1994.
          Betta coccina Vierke, 1979.
          Betta compuncta Tan & Ng, 2006.
          Betta dimidiata Roberts, 1989.
          Betta edithae Vierke, 1984.
          Betta enisae Kottelat, 1995.
          Betta falx Tan & Kottelat, 1998.
          Betta foerschi Vierke, 1979.
          Dusky betta, Betta fusca Regan, 1910.
          Betta hipposideros Ng & Kottelat, 1994.
          Betta ibanorum Tan & Ng, 2004.
          Betta ideii Tan & Ng, 2006.
          Crescent betta, Betta imbellis Ladiges, 1975.
          Betta krataios Tan & Ng, 2006.
          Betta livida Ng & Kottelat, 1992.
          Spotfin betta, Betta macrostoma Regan, 1910.
          Betta mandor Tan & Ng, 2006.
          Betta miniopinna Tan & Tan, 1994.
          Betta patoti Weber & de Beaufort, 1922.
          Betta persephone Schaller, 1986.
          Betta pi Tan, 1998.
          Spotted betta, Betta picta (Valenciennes, 1846).

        - Betta pinguis Tan & Kottelat, 1998.
        - Betta prima Kottelat, 1994.
        - Forest betta, Betta pugnax (Cantor, 1849).
        - Betta pulchra Tan & Tan, 1996.
        - Betta renata Tan, 1998.
        - Toba betta, Betta rubra Perugia, 1893.
        - Betta rutilans Witte & Kottelat, 1991.
        - Betta schalleri Kottelat & Ng, 1994.
        - Betta simplex Kottelat, 1994.
        - Blue betta, Betta smaragdina Ladiges, 1972.
        - Betta spilotogena Ng & Kottelat, 1994.
        - Siamese fighting fish, Betta splendens Regan, 1910.
        - Betta strohi Schaller & Kottelat, 1989.
        - Borneo betta, Betta taeniata Regan, 1910.
        - Betta tomi Ng & Kottelat, 1994.
        - Betta tussyae Schaller, 1985.
        - Betta uberis Tan & Ng, 2006.
        - Howong betta, Betta unimaculata (Popta, 1905).
        - Betta waseri Krummenacher, 1986.
    - Genus *Macropodus*
        - Macropodus erythropterus Freyhof & Herder, 2002.
        - Macropodus hongkongensis Freyhof & Herder, 2002.
        - Roundtail paradisefish, Macropodus ocellatus (de Beaufort, 1933).
        - Paradise fish, Macropodus opercularis (Linnaeus, 1758).
        - Macropodus spechti Schreitmüller, 1936.
    - Genus *Malpulutta*
        - Spotted gourami, Malpulutta kretseri Deraniyagala, 1937.
    - Genus *Parosphromenus*
        - Parosphromenus allani Brown, 1987.
        - Parosphromenus anjunganensis Kottelat, 1991.
        - Parosphromenus bintan Kottelat & Ng, 1998.
        - Licorice gourami, Parosphromenus deissneri (Bleeker, 1859).
        - Spiketail gourami, Parosphromenus filamentosus (Oshima, 1919).
        - Parosphromenus linkei Kottelat, 1991.
        - Parosphromenus nagyi Schaller, 1985.
        - Parosphromenus ornaticauda Kottelat, 1991.
        - Parosphromenus paludicola Tweedie, 1952.
        - Parosphromenus parvulus Vierke, 1979.

    - Genus *Pseudosphromenus*
        - Spiketail paradisefish, Pseudosphromenus cupanus (Cuvier, 1831).
          Pseudosphromenus dayi (Engmann, 1909).
    - Genus *Trichopsis*
        - Pygmy gourami, Trichopsis pumila (Arnold, 1936).
          Threestripe gourami, Trichopsis schalleri (Kottelat & Ng, 1994).
          Croaking gourami, Trichopsis vittata (Cuvier, 1831).
- Subfamily Trichogastrinae
    - Genus *Colisa*
        - Dwarf gourami, Colisa lalia (Hamilton, 1822).
    - Genus *Ctenops*
        - Frail gourami, Ctenops nobilis McClelland, 1845.
    - Genus *Luciocephalus*
        - Pikehead, Luciocephalus pulcher (Gray, 1830).
    - Genus *Parasphaerichthys*
        - Parasphaerichthys lineatus Britz & Kottelat, 2002.
          Eyespot gourami, Parasphaerichthys ocellatus (de Beaufort, 1933).
    - Genus *Polyacanthus*
        - Banded gourami, Polyacanthus fasciatus (Regan, 1910).
    - Genus *Sphaerichthys*
        - Sphaerichthys acrostoma Vierke, 1979.
          Chocolate gourami, Sphaerichthys osphromenoides Canestrini, 1860.
          Sphaerichthys selatanensis Vierke, 1979.
          Sphaerichthys vaillanti Pellegrin, 1930.
    - Genus *Trichogaster*
        - Honey gourami, Trichogaster chuna (Hamilton, 1822).
          Thick lipped gourami, Trichogaster labiosus Day, 1877.
          Pearl gourami, Trichogaster leerii (Bleeker, 1852).
          Moonlight gourami, Trichogaster microlepis (Günther, 1861).
          Snakeskin gourami, Trichogaster pectoralis (Regan, 1910).
          Three spot gourami (aka blue gourami, opaline gourami, and gold gourami), Trichogaster trichopterus (Pallas, 1770).
- Subfamily Osphroneminae (giant gouramis)
    - Genus *Osphronemus*

- Elephant ear gourami, Osphronemus exodon Roberts, 1994.

  Giant gourami, Osphronemus goramy Lacépède, 1801.

  Giant red tail gourami, Osphronemus laticlavius Roberts, 1992.

  Osphronemus septemfasciatus Roberts, 1992.

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Poecilia

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cyprinodontiformes
Family: **Poeciliidae** Garman, 1895
Genera: *Alfaro, Aplocheilichthys, Belonesox, Brachyrhaphis, Carlhubbsia, Cnesterodon, Fluviphylax, Gambusia (mosquitofishes), Girardinus, Heterandria, Heterophallus, Hylopanchax, Hypsopanchax, Lacustricola, Lamprichthys, Limia, Micropanchax, Micropoecilia, Neoheterandria, Pamphorichthys, Pantanodon, Phallichthys, Phalloceros, Phalloptychus, Phallotorynus, Plataplochilus, Poecilia (mollies), Poeciliopsis, Poropanchax, Priapella, Priapichthys, Procatopus, Pseudopoecilia, Quintana, Scolichthys, Tomeurus, Xenodexia, Xenophallus, Xiphophorus (swordtails, platys)*

Poeciliidae is a family of fresh-water fishes which are live-bearing aquarium fish (they give birth to live young). They belong to the order Cyprinodontiformes and include well-known aquarium fish like the guppy, molly, platy, and swordtail.

Live-bearing

Rather than describing the whole family Poeciliidae as "ovoviviparous", it is probably more accurate to say that the family consists of species which are all live-bearers, but that these vary in their reproductive life history: closely allied species within the same clade may show variable maternal provisioning. It is true that many members of the family Poeciliidae are considered to be lecitrophic (meaning that the mother provisions the oocyte with all the resources it needs prior to fertilization, so that the egg is independent of the mother), but others are matrotrophic (literally means "mother feeding": the mother provides the majority of resources to the developing offspring *after* fertilization).

Members of the genus Poeciliopsis, for example, show variable reproductive life history adaptations. Poeciliopsis monacha, P. lucida, and P. prolifica form part of the same clade within the genus *Poeciliopsis*. However, their modes of maternal provisioning vary greatly. *P. monacha* can be considered to be lecitrophic due to the fact that it does not really provide any resources for its offspring after fertilization - the pregnant female is basically a swimming egg sac. *P. lucida* shows an intermediate level of matrotrophy (this literally means "mother feeding" and involves allocation of the majority of resources to the offspring *after* fertilization), meaning that to a certain extent the offspring's metabolism can actually affect the mother's metabolism, allowing for increased nutrient exchange. *Poeciliopsis prolifica* is considered to be highly matrotrophic, and almost all of the nutrients and materials needed for fetal development are supplied to the oocyte after it has been fertilized.

Poeciliopsis elongata, P. turneri, and P. presidionis form another clade which could be considered an outgroup to the *P. monacha/ P.lucida/P.prolifica* clade. These three species are very highly matrotrophic - so much so that in 1947 C. L. Turner described the follicular cells of *P. turneri* as "pseudo-placenta, pseudo-chorion, and pseudo-allantois".

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Poecilia sphenops

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cyprinodontiformes
Family: Poeciliidae
Genus: *Poecilia*
Species: ***P. sphenops***
Binomial name ***Poecilia sphenops*** (Valenciennes, 1846)

Poecilia sphenops is a species of fish, of the genus *Poecilia*, known under the common name **Molly**. They inhabit the coastal brackish and marine waters of Mexico.

This species is one of the ancestors of the Black Molly, a melanistic breed which is black all over. It is one of the most well-known aquarium fishes and nearly as easy to keep and prolific as guppies (for optimal health and breeding success, they demand fresh vegetable food like algae). There are several other popular breeds, like the golden molly nicknamed "24 karat", or the balloon molly, which however has a deformed spine and a decreased lifespan due to the associated health problems. Also, breeds with altered caudal fin structures like lyretails exist. The wild form is in fact quite rarely kept, as it has a rather plain silvery coloration suffused with brown and green hues. If given good care with ample sunlight, high water temperatures and fresh vegetables, they will, however, prove charming fish who make up for their somewhat plain coloration with their lively behavior.

The common molly can produce fertile hybrids with many *Poecilia* species, most importantly the sailfin molly. In the case of black hybrids, they are called Midnight Molly. These are very popular due to their impressive dorsal fins, but require a bit more attention and have a somewhat decreased lifespan.

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Acanthemblemaria spinosa

Barnacle blenny
Conservation status: Secure
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Chaenopsidae
Genus: *Acanthemblemaria*
Species: ***A. spinosa***
Binomial name: ***Acanthemblemaria spinosa*** (Metzelaar, 1919)

The **Barnacle blenny**, *Acanthemblemaria spinosa*, also known as the **tube blenny** or **Spinyhead blenny**, is a member of the blenny family native to the Pacific ocean. It has a mottled black, white and red coloration over the entire body, which is rather elongated. As with most blennies, the head of this animal has small hair-like appendages over the eyes, which are large and red. It ranges in size from .75 inches to 1.5 inches in length.

A. spinosa prefers to inhabit the empty shells of barnacles, hence their name, but will also live in rock and coral crevices. They are opportunistic feeders, preferring to quickly dart out and retrieve food bits from the water column, as opposed to engaging in active foraging and hunting behavior. They eat small crustaceans and other plankton.

In the home aquarium, they are entertaining and only require moderate care. They are reef safe.

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Altolamprologus

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae
Genus: ***Altolamprologus,*** Poll, 1986
Species: *Altolamprologus calvus* , *Altolamprologus compressiceps*

Altolamprologus is a small genus of cichlids with only two species. Both species are laterally compressed cichlids which prey primarily on invertebrates, though will also consume fry of other fish. The species both inhabit areas of the lake with large amounts of rock, most frequently in water two to ten metres in depth. Some authors (eg: Konings, 1998) include *Neolamprologus fasciatus* in the genus *Altolamprologus*.

Contents

- 1 Altolamprologus calvus
- 2 Altolamprologus compressiceps
- 3 In the aquarium
- 4 References

Altolamprologus calvus

A. calvus (Poll, 1978) is a cichlid endemic to Lake Tanganyika in east Africa. The species has greatly laterally compressed body and a high dorsal fin. The fish may grow to 13 cm (5 inches), though are normally smaller. While not highly sexually dimorphic males tend to grow more quickly and to a larger size than most females.

Altolamprologus compressiceps

Altolamprologus compressiceps (Boulenger, 1898) is physically similar to *A. calvus*, though it is deeper bodied and has a shorter snout than *A. calvus*.

In the aquarium

Altolamprologus species is not difficult to keep, if given the standard Lake Tanganyikan water parameters. The species can be a challenge to breed for the novice. It is a very slow-growing species that can take two years to grow from 2.5 cm (1 inch) to sexual maturity. The fish are both cave spawners and will spawn under terracotta pot saucers or in shells.

References

- Konings A (1998) Tanganyikan cichlids in their natural habitat. *Cichlid Press*.

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Bala shark

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Balantiocheilus*
Species: ***B. melanopterus***
Binomial name: ***Balantiocheilus melanopterus***

The **Bala shark** (*Balantiocheilus melanopterus*), also known as the **Tricolor Shark**, **Silver Shark**, or **Shark Minnow**, is a schooling community fish of family Cyprinidae. This species is not a true shark, but is commonly called a "shark" because of its torpedo-shaped body and large fins.

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- 1 General Overview
- 2 Tank preferences
- 3 Native habitat

General Overview

Generally peaceful and good companions to many other types of tropical fish, the Bala shark is an omnivore and will eat other animals if they're small enough to fit in their mouths (including other smaller fish, and shrimp). Bala sharks are widely available in most pet stores, but aren't marketed well since most aquarists buy them before knowing that a bala shark with a large environment can grow up to 14-16 inches long. Shrimp (ghost shrimp, krill, etc.) should have adequate hiding places to keep them from getting eaten. The price of a single Bala Shark usually ranges anywhere from $2.50USD to $7.50USD depending on fish size, store, and geographic location.

Tank preferences

The Bala shark prefers to be grouped in 3-6 specimens (although they can survive alone). They're hardy fish that will tolerate temperature changes, pH changes, and other factors to which other fish may be sensitive.

Very young Bala sharks are sometimes kept in small aquaria. However, given their adult size, schooling behavior, and swimming speed, the fish quickly grow to need much more room. Hobbyists continue to debate over acceptable minimum tank sizes, but generally recommend at least a 6' tank. Many believe the fish is simply too large and too active to be kept in commercial aquaria at all; only enormous, custom-built tanks are acceptable, if any tank at all is. Indoor ponds are also considered feasible housing options and may be better suited to the average aquarist; commercial animal troughs as large as 1000 gallons may easily be acquired via feed stores or Internet sources.

The water pH should be 5.8 to 7.8. The preferable water hardness for this species is soft to medium (5.0-15.0 dGH). Water temperature should be kept between 72 degrees Fahrenheit and 84 degrees Fahrenheit (22 degrees Celsius to 29 degrees Celsius).

Native habitat

The Bala shark's native habitats include streams and rivers in Southeast Asia (Sumatra, Thailand, Borneo, Malaysia, etc.)

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Brine shrimp

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea
Class: Branchiopoda
Order: Anostraca
Family: **Artemiidae,** Grochowski, 1896
Genus:: ***Artemia,*** Leach, 1819
Species: *Artemia franciscana, Artemia gracilis, Artemia monica, Artemia nyos, Artemia parartemia, Artemia parthenogenetica, Artemia persimilis, Artemia pollicaris, Artemia salina, Artemia sinica, Artemia tibetiana, Artemia tunesiana, Artemia urmiana*

Brine shrimp (*Artemia*) are a type of aquatic crustacean. They are found worldwide in saltwater, though not in oceans. Artemia is a well known genus as one variety, the Artemia nyos, a hybrid of Artemia salina, are sold as novelty gifts, most commonly under the marketing name Sea-Monkeys.

Artemia were first discovered in Lymington, England in 1755. There are mixed views on whether all brine shrimp are part of one species or whether the varieties that have been identified are properly classified as separate species.

Un-hatched brine shrimp are metabolically inactive and can remain in total stasis for several years while in dry oxygen-free conditions, even at temperatures below freezing. This characteristic is called Cryptobiosis meaning "hidden life" (also called Diapause). Once placed in water, the cyst-like eggs hatch within a few hours, and will grow to a mature length of around one centimeter on average. Brine shrimp have a biological life cycle of one year. This short life span, and other characteristics such as their ability to remain dormant for long periods, have made them invaluable in scientific research, including space experiments.

Brine shrimp can tolerate varying levels of salinity, and a common biology experiment in school is to investigate the effect of salinity levels on the growth of these creatures. Also, because they have no brain and a very crude nervous/spinal system, they can be used for many experiments without having to worry about animal ethics.

The nutritional properties of newly hatched brine shrimp make them particularly suitable to be sold as aquarium food as they are high in lipids and unsaturated fatty acids (but low in calcium). These nutritional benefits are likely to be one reason that brine shrimp are found only in highly salinated waters, as these areas are uninhabitable for potential predators.

The nauplii, or larvae, of brine shrimp are less than 500 micrometers when they first hatch. They eat micro-algae, but will also eat yeast, wheat flour, soybean powder, or egg yolk.

Artemia monica, the variety commonly known as Mono Lake brine shrimp, are found only in Mono Lake, Mono County, California. In 1987, Dr. Dennis D. Murphy from Stanford University petitioned the United States Fish and Wildlife Service to add Artemia monica to the endangered species list under the Endangered Species Act 1973. Despite there being trillions of these creatures in Mono Lake, it was felt that rising levels of salinity and sodium hydroxide concentration of the lake would endanger them because of the increase in pH. However, the US Fish and Wildlife Service reported in the Federal Register on 7 September 1995 that this brine shrimp did not warrant listing after the threat to the lake was removed following a revised policy by the California State Water Resources Control Board

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Bubble nest

Bubblenests, also spelled **bubble nests** or **bubble-nests**, created by some fish species, are floating masses of bubbles blown with an oral secretion, saliva bubbles, and occasionally aquatic plants, or an area for egg deposit attached at the bottom.

Contents

- 1 Species which build Bubblenests
- 2 Construction of Bubblenests
- 3 Bubblenests and Breeding
- 4 Triggers of Bubblenest Construction
- 5 See also

Species which build Bubblenests

Gouramis (including Betta species) and some sunfish, catfish and cichlids create bubblenests. Anabantidae are the most commonly recognized family of bubblenest makers. The nests are constructed as a place for fertilized eggs to be deposited while incubating and guarded by the male until the fry hatch. They can often be seen above a content male betta.

Construction of Bubblenests

The nests are always built by the male and their size, position and shape depends on the species. The nest is most often made at the water surface, sometimes among floating plants, whether natural or artificial. Occasionally, every object floating will have bubbles on it.

Bubble nests created by male betta/Siamese Fighting Fish (Betta splendens) are made from air bubbles coated with saliva to increase durability. This makes a louder noise than regular breathing and is often frantic behavior.

Bubblenests and Breeding

After spawning, the eggs float up into the bubble nest, or are carried there held in the mouth by the male, as if he is eating them. The male lodges them in the nest to protect them, and then protects the brood by chasing away the female and any other intruders, concentrating on the eggs in the nest, retrieving any eggs or fry that fall from the nest and keeping the nest in repair. The father will guard the eggs constantly until the fry hatch in 24-48 hours and be suspended from the nest. For the next few weeks, they will stay nearby being tended by the father.

Triggers of Bubblenest Construction

Bubble nests are built even when not in presence of female or fry (though often a female swimming past will trigger the frantic construction of the nest). Males will build bubble nests of various sizes and thicknesses, depending on the male's territory and personality. Some males build constantly, some occasionally, some when introduced to a female and some do not even begin until after spawning. Some nests will be large, some small, some thick.

Various things have been shown to stimulate bubble nest construction, such as quick temperature changes, barometric changes, materials in the tank and presences of other males or females.

See also

- Catfish

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Daphnia

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea
Class: Branchiopoda
Order: Cladocera
Family: Daphniidae
Genus: ***Daphnia,*** Müller, 1785
Species

- Subgenus *Daphnia*

    D. ambigua
    D. arenata
    D. catawba
    D. cheraphila
    D. latispina
    D. melanica
    D. middendorffiana
    D. minnehaha
    D. neo-obtusa
    D. obtusa
    D. oregonensis
    D. parvula
    D. pileata
    D. prolata
    D. pulex
    D. pulicaria
    D. retrocurva
    D. tenebrosa
    D. villosa

- Subgenus *Hyalodaphnia*

    D. curvirostris
    D. dentifera
    D. dubia
    D. laevis
    D. longiremis
    D. mendotae
    D. thorata
    D. umbra

- Subgenus *Ctenodaphnia*

    D. brooksi
    D. ephemeralis
    D. exilis
    D. lumholtzi
    D. magna
    D. salina
    D. similis

Daphnia are small, mostly planktonic, crustaceans, between 0.2 and 5 mm in length. Daphnia are members of the order Cladocera, and are one of the several small aquatic crustaceans commonly called water fleas because of their saltatory swimming style (although fleas are insects and thus only very distantly related). They live in various aquatic environments ranging from acidic swamps to freshwater lakes, ponds, streams and rivers.

Contents

- 1 Biology
- 2 Reproduction
- 3 Lifespan
- 4 Uses
- 5 Ecology

Biology

The division of the body into segments is nearly invisible. The head is fused, and is generally bent down towards the body with a visible notch separating the two. In most species the rest of the body is covered by a carapace, with a ventral gap in which the five or six pairs of legs lie. The most prominent features are the compound eyes, the second antennae, and a pair of abdominal setae. In many species, the carapace is translucent or nearly so and as a result they make excellent subjects for the microscope.

Even under relatively low power, it is possible to observe the feeding mechanism working, watch immature young moving in the brood-pouch, observe the eye being moved by the ciliary muscles and even watch blood corpuscles being pumped round the circulatory system by the simple heart. The heart is at the top of the back, just behind the head. and their average heart rate is approximately 180bpm under normal conditions. Daphnia, like many animals, are prone to alcohol intoxication, and make excellent subjects for studying the effects of the depressant on the nervous system - due to the translucent exoskeleton, and the visibly altered heart rate. They are tolerant of being observed live under a cover slip and appear to suffer no harm when returned to open water. This experiment can also be done using caffeine and watching an increase in heart rate.

A few *Daphnia* prey on tiny crustaceans and rotifers, but most are filter feeders, ingesting mainly unicellular algae and various sorts of organic detritus including protists and bacteria. Daphnia can be kept easily on a diet of yeast. Beating of the legs produces a constant current through the carapace which brings such material into the digestive tract. The trapped food particles are formed into a food bolus which then moves down the digestive tract until voided through the anus located on the ventral surface of the terminal appendage. The first and second pair of legs are used in the organisms' filter feeding ensuring large unabsorbable particles are kept out while the other sets of legs create the stream of water rushing into the organism. Swimming, on the other hand, is powered mainly by the second set of antennae which are larger in size than the first set. The action of this second set of antennae is responsible for the jumping motion.

Reproduction

Daphnia reproduce parthenogenetically usually in the spring until the end of the summer. One or more juvenile animals are nurtured in the brood pouch inside the carapace.The newly hatched Daphnia must moult several times before they are fully grown into an adult usually after about two weeks. The young are small copies of the adult; there are no true nymphal or instar stages. The fully mature females are able to produce a new brood of young about every ten days under ideal conditions. The reproduction process continues while the environmental conditions continue to support their growth. Winter or drought conditions brings an end to the production of new female generations. At this time, the reproduction method changes. Parthenogenic males are produced, followed by mating and fertilisation of the eggs. Fertilised eggs are termed winter eggs and are provided with extra shell layer called ephippium. The extra layer preserves and protects the egg inside from harsh environmental conditions until the more favourable times, such as spring, when the reproductive cycle is able to take place once again.

Males are only found at times of harsh environmental conditions, typically during portions of the year of scarce resources due to population overgrowth or winter conditions, and even then may make up considerably less than half the population, in some species being unknown entirely. They are much smaller in size than the female and they typically possess a specialised abdominal appendage which is used to grasp a female from behind and prise open her carapace and insert a spermatheca. Their appearance is for the creation of resting or winter eggs, allowing for the survival of the population through harsh conditions.

In addition to the production of eggs capable of overwintering, this switch to sexual reproduction has also been proposed to allow greater offspring variation (through genetic recombination) which may be useful in varied or unpredictable conditions, this idea is often proposed under the name of the lottery model.

Lifespan

The lifespan of a *Daphnia* does not exceed one year and is largely temperature dependent. For example, individual organisms can live up to 108 days at 3°C while some organisms live for only 29 days at 28°C. A clear exception to this trend is during the winter time in which harsh conditions limit the population in which females have been recorded to live for over six months. These females generally grow at slower rate but in the end are larger than ones under normal conditions.

Uses

Daphnia provide an important source of food for many larger aquatic organisms including various fish species (e.g. lake trout) and the immature stages of many insects including the Odonata-dragonflies and dameselflies.

They are easy to culture in the laboratory, and *D.magna* has been a model species for developing the Dynamic Energy Budget theory. They are frequently used to test the effects of toxicants on reproduction and survival.

Daphnia are sold by aquatic retailers in both live and freeze-dried form as food for aquarium fish. Their tiny size renders them edible in live form even for fish as small as the neon tetra

Daphnia may also be used to clear unwanted algae from fish tanks, provided they are not eaten by the fish.

Many speciea of Daphnia are used in aquatic toxicology. As experimental animals they have many advantages being simple to produce in large numbers and exhibiting consistent responses to toxins.

Daphnia is considered an indicator species or sentinel species which is an indicator of ecosystem health.

Ecology

The populations of several water flea species are considered threatened. The following are listed as vulnerable by IUCN: *Daphnia nivalis*, *Daphnia coronata*, *Daphnia occidentalis*, and *Daphnia jollyi*.

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Deep sand bed

A **deep sand bed** (sometimes abbreviated **DSB** and also called a "plenum") is a filtration method used in some saltwater aquariums. A deep sand bed, like the Berlin Method, is designed to cultivate anaerobic bacteria in the bottom layers of sand, which can convert nitrate to nitrogen gas, thus eliminating the toxic substance from the water.

A deep sand bed is generally defined as a bed of fine sand at least 4 to 6 inches deep. This depth is necessary to ensure that there will be enough water receiving poor circulation. An established deep sand bed is actually made up of live sand which, like live rock, is full of bacteria and other marine organisms such as worms, crabs, snails, and stars. These creatures dig through the top inch or so of sand in search of nourishment, which helps circulate water much deeper into the sand than would be possible without their aid.

Deep sand beds can be made of any material, but typically fine or "superfine" sand is used, having a size anywhere between 1 mm and 0.05 mm. A larger size might allow for better circulation, which would in turn require a greater depth. At the same time, the larger particles could be too heavy for the worms and other inhabitants to move around, which would limit their ability to help. Lastly, very large particles (2 mm or larger) are very likely to accumulate detritus, which would necessitate periodic siphon cleaning. A well-chosen fine grain sand, on the other hand, will create a deep sand bed which may never need cleaning.

Fish anatomy

Fish anatomy is primarily governed by the physical characteristics of water, which is much denser than air, holds a relatively small amount of dissolved oxygen, and absorbs light more than does air.

Contents

- 1 Body
- 2 Fins
- 3 Scales
- 4 Internal organs

Body

Nearly all fish have a streamlined body plan, which is divided into head, trunk, and tail, although the dividing points are not always externally visible.

The head includes the snout, from the eye to the forwardmost point of the upper jaw, the operculum or gill cover, (absent in sharks) and the cheek, which extends from eye to preopercle. The lower jaw defines a chin. The head may have several fleshy structures known as barbels, which may be very long and resemble whiskers. Many fish species also have a variety of protrusions or spines on the head. The nostrils or nares of almost all fishes do not connect to the oral cavity, but are pits of varying shape and depth.

The outer body of many fish is covered with scales. Some species are covered instead by scutes. Others have no outer covering on the skin; these are called **naked** fish. Most fish are covered in a protective layer of slime (mucus).

The lateral line is a sense organ used to detect movement and vibration in the surrounding water. It consists of a line of receptors running along each side of the fish.

The caudal peduncle is the narrow part of the fish's body to which the caudal or tail fin is attached. The hypural joint is the joint between the caudal fin and the last of the vertebrae.

Photophores are light-emitting organs which appears as luminous spots on some fishes. The light can be produced from compounds during the digestion of prey, from specialized mitochondrial cells in the organism called photocytes, or associated with symbiotic bacteria, and are used for attracting food or confusing predators

Fins

The fins are the most distinctive features of a fish.

- The dorsal fins are located on the back. A fish can have up to three of them. There are two types of dorsal fin rays, spiny and soft. A fin can contain only spiny rays, only soft rays, or a combination - if the latter the spiny rays are always anterior. These comments about fin rays also apply to the anal, pectoral, and pelvic fins. The dorsal fin serves to protect the fish against rolling and assist in sudden turns and stops.
- The caudal fin is the tail fin, located at the end of the caudal peduncle.
- The anal fin is located on the ventral surface behind the anus. This fin is used to stabilize the fish while swimming.
- The paired pectoral fins are located on each side, usually just behind the operculum, and are homologous to the forelimbs of tetrapods.
- The paired pelvic or ventral fins are located ventrally below the pectoral fins. They are homologous to the hindlimbs of tetrapods.
- The adipose fin is a soft, fleshy fin found on the back behind the dorsal fin and just forward of the caudal fin. It is absent in many fish families, but is found in Salmonidae, characins and catfishes.
- Some types of fast-swimming fish have a horizontal caudal keel just forward of the tail fin. This is a lateral ridge on the caudal peduncle, usually composed of scutes (see below), that provides stability and support to the caudal fin. There may be a single paired keel, one on each side, or two pairs above and below.
- The "horns" of manta rays and their relatives are called cephalic fins.
- Finlets are small, rayless, non-retractable, fins between the last dorsal and/or anal fin and the caudal fin. They are found on fast swimming fish such as tuna.

For every fin, there are a number of fish species in which this particular fin has been lost during evolution.

Scales

There are four types of fish scales.

1. Placoid scales, also called dermal denticles, are similar to teeth in that they are made of dentin covered by enamel. They are typical of sharks and rays.
2. Ganoid scales are flat, basal-looking scales that cover a fish body with little overlapping. They are typical of gar.
3. Cycloid scales are small oval-shaped scales with growth rings. Bowfin and remora have cycloid scales.
4. Ctenoid scales are similar to the Cycloid scales, with growth rings. They are distinguished by the spines that cover one edge. Halibut have this type of scale.

Another, less common, type of scale is the scute, which is:

- an external shield-like bony plate, or
- a modified, thickened scale that often is keeled or spiny, or
- a projecting, modified (rough and strongly ridged) scale, usually associated with the lateral line, or on the caudal peduncle forming caudal keels, or along the ventral profile.

Some fish (eg pineconefish) are completely or partially covered in scutes.

Internal organs

- The gas bladder, or swim bladder, is an internal organ that contributes to the ability of a fish to control its buoyancy, and thus to stay at the current water depth, ascend, or descend without having to waste energy in swimming. It is often absent in fast swimming fishes such as the Tuna and Mackerel families.
- The gills, located under the operculum, are a respiratory organ for the extraction of oxygen from water and for the excretion of carbon dioxide. They are not usually visible, but can be seen in some species eg the frilled shark.
- Gill rakers are bony, finger-like projections of the gill arch filaments which function in retaining food organisms.

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Fish diseases

Fish are susceptible to **fish diseases** just as any other organism. There are hundreds of afflictions that can effect the health of fish. Fish disease has remained a rudimentary branch of veterinary medicine. The reasons are their miniature nature makes tests more difficult and cheap price of most fish exceeds expensive tests and medication cost. Fish diseases can be referred to as etiology organ/system most severely affected. Communicable disease can easily affect most fishes in the aquarium due to limited volume of water and increased number of fish compared to natural environments. Many diseases in captive fish are avoidable and preventible. Water conditions are important factors. In spite of all precautions, disease episodes may still occur in the aquarium especially when fish face environmental stresses.

`*Who hears the fish when they cry?* - Henry David Thoreau 1849`

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Prevention

Disease cures are almost always more expensive and less effective than simple prevention measures, including moving between fisheries to avoid spreading disease.

Identified precautions:

- Avoid introducing infected stock into the water.
- Avoid stressing the fish
    - Keep fish in ideal water conditions
        - Don't overcrowd the aquarium
        - Don't overfeed the fish
        - Fish bowls? No please.
- Don't introduce external disease sources
    - Qurantine newly bought fish
    - Don't buy from shops with diseased fish
    - Think about introducing other plants and invertebrates
- Monitor the fish
    - Keep a close look at the fishes at least a couple of minutes a day, such as during fish feeding.
    - As a rule of thumb, if the fish appears distressed, remove it immediately and monitor it for a couple of days.
- Remove infected fish from your populated tank
- Avoid using unknown chemicals in your tank
    - Never use soap or detergent when cleaning out anything that is to be in the aquarium

Fish disease etiology

- Bacterial infections
  - External bacterial infection
    - Pseudomonas fluorescens
      Cotton Mouth, Mouth Fungus, Chondrococcus columnaris
      Scale Protrusion
      Myxobacteriosis
      Tail Rot & Fin Rot
  - Internal bacterial infection
  - Frunculosis (Aeromonas salmonicida)
    - Fish Dropsy
      Red pest
    - Septicemia
      - Pop Eye
    - Mycobacteria
      - Fish Tuberculosis, (Curved Spine), Crooked Spine, Mycobacterium piscium
- Fungal infections
  - Saprolegnia
    Ichthyosporidium
    Fungal cataract
- Mould infections
  - Water moulds
    - Oomycetes
      Saprolegnia
- Parasitic Disorders
  - Gyrodactylus salaris
  - Protozoa
    - Malawi Bloat
      Costia
      Ichthyophthirius
      Cryptocaryon
      Oodinium
      Trypanosoma
      Velvet disease
      Brooklynella hostilis
      Hexamita
      Glugea
      Henneguya
      Chilodonella
  - Myxosporea

    - Ceratomyxa shasta
      Kudoa thrysites
      Tetracapsuloides bryosalmonae
      Ceratomyxa shasta
  - Microspora
    - Neon Tetra Disease Pleistophora hyphessobryconis
  - Helmintic
    - Leeches
      Nematoda
      Trematoda
    - Platyhelminthes, Flat worms
      - Planaria
        Monogenea
    - Cercaria and Metacercaria
      - Black Spot, Diplostomiasis
  - Crustaceans
    - Argulus (Fish louse)
    - Copepods
      - Lernea Anchor worms
- Viral Disorders
  - Koi Herpes virus (KHV)
    Infectious salmon anemia
    Lymphocystis
- Metabolic Disorders
- Water conditions
  - Physical conditions
    - Too many fish
    - The tank is too small
    - New tank syndrome (NTS)
  - O_2
    - Insufficient aeration
  - PH
    - Acid Water
    - Alkaline Water
    - pH fluctuations greater than 0.2 units/day
    - Adding concentrated acid/alkaline (Chemical burns)
  - Water Hardness
    - High GH
    - Low Gh
  - Temporary Hardness
    - High Kh
    - Low Kh
  - Water temperature

    - Water Too hot
    - Water Too Cold
  - Poisoning
    - Ammonia Poisoning
    - Nitrite poisoning
    - Copper Poisoning
    - Clorine Poisoning
    - Chloramine Poisoning
- Malnutrition
  - Undefined
    - Rotting nose disease
  - Underfeeding
  - Overfeeding
  - Wrong food
  - Foods not varied
  - Vitamin deficiency
    - Fat Soluble Vitamins
      - Vitamin A
      - Vitamin D
    - Water Soluble Vitamins
      - Thiamine (B1)
      - Riboflavin (B2)
      - Nicotinic Acid (niacin, B3)
      - Pantothenic Acid (B5)
      - Pyroxidine (B6)
      - Cyanocobalamin (B12)
      - Ascorbic Acid (C)
        - Hole in the head disease
      - Biotin (H)
      - Choline
      - Folic Acid (M)
      - Inositol
      - p-Aminobenzoic Acid
      - Vitamin E
  - Mineral deficiency
    - Calcium
  - Constipation
- Injuries
  - Incompatible species
  - Improper handling
  - Sharp decors
- Tumors
  - Benign
  - Malign

- Congenital Abnormalities
    - Beneficial
        - Albinism
        - Extra finnage
    - Undesirable

Fish disease by affected organ system

- Neurological Disorders
- Body Cavity
- Eye Disorders
    - Cloudy cornea
    - Blindness
    - Cataract
    - Black Spot
    - Pop Eye , exophtalmia
- Fecal Disorders
- Fin Disorders
    - Fin rot
- Gallbladder
- Gill Disorders
    - Gill flukes (Dactylogyrus)
- Intestinal Disorders
- Kidney Disorders
- Liver Disorders
- Locomotor Disorders
    - Spine
        - Scoliosis
- Mouth disorders
    - Cotton Mouth
- Skin Disorders & Changes In Color
    - Anchor Worm
    - Black spots (diplopstomiasis)
    - Chilodonella
    - Costia
    - Dermocystidium
    - Fish Lice (Argulus)
    - Fungus
    - Ich (white spot disease)
    - Scale Loss (stress)
    - Skin flukes (Gyrodactylus)
    - Slime Disease
    - Ulcers
        - Ulcerative dermal necrosis
    - Velvet
- Swim Bladder Disease
    - Congenitally deformed
    - Tumor adjacent to the swim bladder
    - Constipation

○ Malnutrition
○ Chilling
○ temperature fluctuations
○ Serious parasitic infestation
○ Serious bacterial infection

Fish Disease treatment

Basics

If the disease cause is not obvious, check water conditions, including temperature, pH, GH, KH, NH3, NH4, PO4, NO2. Observe the fish for symptoms. Check any recent changes.

Hospital Tank

Diseased fish should be isolated whenever possible so they are not likely to spread infections among other healthy fish in the tank. The best way to isolate sick fish is to set up a hospital tank. If possible move all sick fish to a hospital tank, without sand, live plants and decorations. If the treatment is an antibiotic antiseptic or copper based, remember to remove all carbon from the filtration system. Make sure the biological filtration in your aquarium which cycle harmfull ammonia and nitrites is not destroyed by drugs. The tank should be furnished with a reliable heater that will not permit much temperature variance. The tank should be furnished with an air stone. After treating the sick fish, disinfect the tank.

Baths

An alternative means of treating a fish is to give it a short bath in a bucket containing water and a medication or salt.

Salt bath

A salt bath is a good way of treating the fish without damaging the beneficial bacteria. It is a good antiseptic and fungicide. Most table salts may contain additives like magnesium sulfate to keep them from clumping and appear whiter, which might not be beneficial to fish. Aquarium salt is recommended, although Kosher salt or rock salt is satisfactory.

Heat Therapy

Heat therapy of raising the water temperature, can be administered to kill certain parasites. The temperature should be raised gradually. Sometimes diseased fish cannot handle such a temperature change, or the species can not tolerate high temperatures. Discontinue treatment if any side effects occur. Aeration is necessary since less oxygen is dissolved in warm water.

Medications

Commercial fish medications are not regulated by any government agency. This means that some commercial medications have not been tested for safety or effectiveness. Thus some medications may be completely useless and may be even harmful to aquarium inhabitants.

Treatment Options

- Conservative treatment
  - Temperature modifications
  - Changing water conditions
- Pharmaceuticals
  - Drug baths
  - Topical drugs
  - Feeding drugs
  - Injecting drugs
- Surgery
- Killing the fish

Example drugs used in Fish treatment

- Antibiotics
  - Tetracycline
    Chloromycetin
    Amoxicillin
- Antihelmintic
  - Parachlorometaxylenol
    Dimilin
- Antifungals

    - Phenoxethol
- Antiseptics
    - Malachite green
    Formalin
    Potassium permanganate
    Methylene blue
    Mercurochrome
    Acriflavine, (trypaflavine)
    Mardel's Maroxy
    Quaternary ammonium compounds: (QACs)
    Monacrin (monoaminoacridine)
- Chloramine-T
  Copper
  Organophosphates
  Salt
- Anti constipation
    - Parrafin oil
    Glycerol
    Castor oil
- Other
    - Trichlorofon
    Maracyn
    Paragon
    Metronidazole
    Trifon
    Oxygenex

Complications

- Damaging Nitrogen cycle
  Damaging aquarium plants
  Damaging freshwater invertebrates in aquarium
  Overdose

References

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2. ISBN 1582450498 AZ of Tropical Fish Diseases & Health Problems, Peter Burgess
3. ISBN 0866227032 Handbook of Fish Diseases, Dieter Untergasser
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Gobiosoma multifasciatum

Green banded goby
Conservation status: Secure
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Gobiidae
Genus: *Gobiosoma*
Species: ***G. multifasciatum***
Binomial name: ***Gobiosoma multifasciatum,*** (Steindachner, 1876, 1858)

The **Green banded goby**, *Gobiosoma multifasciatum*, is a member of the goby family native to the western Atlantic ocean, from the Bahamas and Central America to northern South America. As the name implies, they are dark green with 17-23 pale green bars, and have a brown stripe through the eye interrupted with a bright red spot.

Equally bright as their coloration is their personality; they are valued additions to reef aquaria, with a reputation for being friendly and entertaining.

Contents

- 1 Description
- 2 In the aquarium
- 3 Conservation status
- 4 Reproduction

Description

G. multifasciatum have a generally fusiform shape. At maturity they can reach a length of 3.5 cm.

See also: Fish anatomy

In the aquarium

The **Green banded goby** is popular with aquarists and is generally considered to be reef safe. It is especially suited to nano reef tanks because of its small size.

Because of territorial issues with their own kind in the small confines of a tank, they are best kept singly or as a breeding pair.

Conservation status

Gobiosoma multifasciatum is not found on the IUCN Red List. The species is highly resilient, with localized populations able to double within fifteen months.

Reproduction

Gobiodon sp. start life as females, and are bi-directional protogynous hermaphrodites, meaning that when paired up, if necessary, one changes sex to form a breeding pair. In the case of two females forming a pair, the larger of the two becomes male, and in the case of two males, the smaller changes sex to become female.

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Ichthyology terms

Ichthyology uses several terms that are unique to the science.

Contents: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

- Abdomen: belly
- Abdominal: pertaining to the belly
- Actinosts: a series of bones at the base of the pectoral rays.
- Acuminate: tapering gradually to a point
- Acute: sharp, pointed
- Adipose fin: a small fleshy fin which lacks fin rays.
- Adnate: joined together
- Adpressed: pressed against the body
- Anal fin: the fin on the median line behind the vent
- Anal fin origin: the most anterior point of the anal fin base
- Ankylosed: grown firmly together
- Anterior: relating to the front portion
- Antrose: turned forward
- Approximate: placed close together
- Asperity: roughness of surface
- Asymetrical: without symmetry
- Attenuate: tapering to a point, usually in reference to a tail
- Axillary: pertaining to the axilla or upper angle of the pectoral fin
- Axillary process: an enlarged, pointed scale projecting from the insertion of the pectoral or pelvic fin.)

B

- Barbel: an elongated fleshy projection, usually about the head
- Basal: pertaining to the base, at the base
- Base: the part of a projection, (commonly a fin), which is connected to the body
- Bathypelagic: living at a depth between 1000 m and 4000 m, but well off the bottom
- Benthic: bottom-dwelling, living on the sea bed
- Benthopelagic: pertaining to fishes that swim just above the seabed at depths below about 200 m (the edge of the continental shelf)
- Bicuspid: having two cusps or points
- Bifid: cleft in two
- Bifurcate: forked, or divided into two parts or branches
- Branchial: pertaining to the gills
- Branchial aperture: the gill opening
- Branchiostegals, Branchiostegal ray(s): bony rays supporting the gill membranes behind the lower jaw
- Bristle: a stiff hair-like projection
- Buckler: a bony shield
- Bycatch: species other than the target species that are caught incidentally in a trawl

C

- Caniniform: shaped like a canine tooth, conical in form
- Carapace: a horny or bony covering encasing the body
- Carinate: keeled, having a ridge along the middle line
- Caruncle: a fleshy outgrowth
- Caudal: pertaining to the tail
- Caudal fin: the tail fin
- Caudal peduncle: the region of the body between the end of the anal fin and the base of the caudal fin
- Ciliated: fringed with eyelash-like projections
- Cirri: small, thin appendages, often subdivided into branches.
- Cirrus: singular of cirri (see above)
- Claspers: the external reproductive organs of male sharks, rays and chimaeras
- Coalesced: grown together
- Compressed: flattened laterally
- Confluent: joined together
- Conical: cone shaped, with a cylindrical base and a pointed tip
- Corselet: a scaly covering behind the pectorals of some fishes
- Countershading: body colouration which is dark above and lighter below
- Crenulate: having the edge slightly scalloped
- Cutaneous: pertaining to the skin
- Ctenoid: rough-edged
- Cycloid: smooth-edged

D

- Deciduous: temporary, falling off
- Demersal: living on or near the sea bed
- Dendritic: resembling a tree or shrub
- Denature: the "unfolding" of a protein resulting in a lessening of its biological properties. In the case of some fish toxins, denaturing with hot water can lessen painful symptoms.
- Dentate: with tooth-like projections
- Denticle, denticulate: a little tooth, having an edge with small projecting teeth, the placoid scales of cartilaginous fishes
- Depressed: flattened from top to bottom
- Dermal: pertaining to the skin
- Dewlap: a fold of loose skin
- Disc: the flattened head and body of various fishes such as stingrays, which also commonly includes the pectoral and ventral fins
- Distal: remote from the point of attachment
- Dorsal: pertaining to the back
- Dorsum: the upper (dorsal) surface of the head or body
- Dorsal fin: the fin on a fish's back
- Dorsal fin origin: the most anterior point of the dorsal fin base

E

- Elasmobranchs: cartilaginous fishes - sharks, rays and allies
- Electrocyte: a cell that generates electricity
- Elongate: extended, drawn out
- Emarginate: with the margin slightly hollowed
- Endemic: restricted to a particular region, for example endemic to Australia
- Entire: with a smooth margin
- Epibenthic: referring to organisms living on the bottom surface
- Epipelagic: referring to organisms living in the region between the surface and 200 m depth
- Erectile: capable of being raised or erected, often referring to spines
- Esca: the lure or "bait" on the end of the illicium of some anglerfishes and relatives
- Estuarine: living in estuaries

F

- Falcate: scythe-shaped, long, narrow, and curved
- Falciform: curved like a scythe
- Filament: a slender or thread-like structure
- Filiform: thread-like
- Fimbriate: fringed at the margin
- Finlet: a small fin, positioned behind the dorsal or anal fins, that is supported by a ray or rays
- Fluviatile: living in rivers
- Free rear tips (of fins): the posterior tip of the fin that is closest to the most posterior point of the fin base
- Frontal ridge: a ridge running along the top of the head along the midline
- Furcate: forked
- Fusiform: tapering towards both ends

G

- Gill arches: the bony arches to which the gills are attached
- Gill cover: or bony flap that covers the gills, the operculum
- Gill filaments: a series of projections along the posterior edge of the gill arch, the site of gas exchange
- Gill membranes: membranes covering the gill openings, attached to the branchiostegals
- Gill opening: opening behind each operculum, leading to the gills
- Gill rakers: a series of appendages along the anterior edges of the gill arches
- Gills, Branchiae: organs for breathing the air contained in water
- Glossohyal: the tongue bone
- Gonopodium: a modification of the anal fin of males of certain live-bearing species (i.e. family Poeciliidae), that is used to transfer reproductive products to the female during mating.
- Gravid: Sexually ripe
- Gular region: pertaining to the region behind the chin and between the sides of the lower jaw

H

- Head length: the distance from the tip of the snout (or upper lip) to the most posterior point of the opercular margin
- Homology: similarity of features based on common evolutionary descent
- Hyperostosis: a condition resulting in enlargement of areas of bone.
- Hyaline: translucent or transparent
- Hypural joint: the joint between the caudal fin and the last of the vertebrae
- Hypural plate: the flattened bony plate at the posterior end of the vertebral column, formed from parts of the posterior vertebrae.

I

- Ichthyoplankton: fish eggs and larvae
- Illicium: a "fishing rod-like" appendage on the head, usually a modified dorsal fin spine
- Imbricate: overlapping, like the shingles on a roof
- Incised: with a notched margin (often referring to fin membranes)
- Incisors: the front or cutting teeth
- Inferior: pertaining to the lower side (usually of the head)
- Interdorsal: between the dorsal fins
- Interorbital: the space between the orbits
- intromittent organ: a structure to facilitate sperm transfer in some internally fertilizating species
- Iris lappet: a fleshy flap or lobe-like structure in the eye, short and rounded, simple or multiply branched.
- Isthmus: the fleshy projection of the body separating the gill openings

J

- Jugular: pertaining to the throat
- Juxtaposed: placed near together

K

- Kidneys: organs involved in excretion and regulation of water balance

L

- Lanceolate: spear-shaped, gradually tapering toward the extremity
- Labial: pertaining to the lips
- Labial furrows: shallow grooves around the lips
- Labial papillae: small fleshy projections around the lips
- Lateral: at or toward the side
- Lateral line: a series of muciferous tubes forming a raised line along the side of the body
- Leptocephalic: tallness and narrowness of the skull - in fish usually refers to "elongate highly compressed transparent, ribbon-like larval stage" (source FishBase glossary)
- Liver: a digestive and storage organ
- Longitudinal series (scales): the number of scale rows above the lateral line from the first pored lateral line scale to the caudal fin base.
- Lunate: shaped like a crescent moon, with long upper and lower lobes

M

- Maxilla, Maxillary: the upper jaw, or pertaining thereto
- Maxillae, Maxillaries: the hindmost bones of the upper jaw; preceded by the premaxillaries
- Median, medially: pertaining to the middle
- Median fins: fins located on the median line of the fish; the dorsal, anal and caudal fins
- Mediolateral: between the middle and the sides
- Mesocoracoid: a bone of the pectoral arch or shoulder girdle
- Mesopelagic: refers to the region of the open ocean between 200 m and 1000 m in depth
- Mesopelagic fishes: fishes that live in the mesopelagic zone
- Midwater: the middle stratum of water, well below the surface and well above the seabed. See also mesopelagic.
- Midwater fishes: fishes that live in the midwater
- Molars: blunt and rounded grinding teeth
- Morphology: form and structure of an organism
- Muciferous: producing or containing mucous or slime
- Myotomes: blocks of lateral trunk muscles

N

- Nape: upper surface of the body behind the head and before the dorsal fin
- Nasal: pertaining to the nostrils
- Nasoral: between the nostrils and mouth
- Nictitating membrane: an inner eyelid
- Notochord: a rudimentary of embryonic spinal column
- Nuchal: pertaining to the nape

O

- Obsolete: faintly marked, scarcely evident
- Obtuse: blunt
- Occipital: pertaining to the posterior part of the skull
- Ocellus: an eye-like spot
- Ocular: pertaining to the eye
- Odontode: a dermal tooth
- Oesophagus: the gullet
- Opercule, operculum: the bony flap that covers the gills
- Opercular: pertaining to the operculum
- Opercular spine: spine projecting from the operculum (view the fish figure)
- Orbit: the eye socket
- Origin: the most anterior point of a fin base
- Osseus: bony
- Ovate: egg-shaped

P

- Palate: the roof of the mouth
- Palatines: the bones on each side of the palate
- Papilla (papillae): a small fleshy projection(s)
- Papillose: covered with papillae
- Pectoral: pertaining to the breast
- Pectoral fins: the anterior or uppermost of the paired fins, which correspond to the anterior limbs of the higher vertebrates
- Pectoral girdle: the bones to which the pectoral fin is attached
- Peduncle: usually referred to as the caudal peduncle, the region of the body between the end of the anal fin and the base of the caudal fin
- Pelagic: living on or in the open seas
- Pelvic girdle: the bones to which the ventral fins are attached
- Pelvic fins: paired fins behind or below the pectoral fins
- Pharyngeal bones: bones behind the gills in the oesophagus or gullet
- Pharyngeal teeth: teeth within the pharynx
- Pharynx: the back part of the throat, into which the gill slits open
- Photophore: a circular light-producing organ on the surface of a fish
- Posterior: towards the hind end of the fish
- Postorbital: behind the eye
- Precaudal: anterior to the tail portion
- Premaxillaries: two bones forming the front portion of the upper jaw
- Preocular spine: spine positioned above and in front of the eye
- Preopercle, preoperculum: the bone between the cheek and the gill cover
- Preopercular spine: spine projecting from the preopercule (see preopercle) (view the fish figure)
- Preorbital: the area under and in front of the eyes
- Protractile: capable of extending forward
- Protrusible: capable of extending forward, often referring to the jaws of fishes
- Proximal: nearest
- Pseudobranchiae: small gills developed on the inner side of the gill cover
- Pseudoclasper: stiff ossified lobes or prongs in the tip of the intromittent organ
- Pterygiophore: an internal cartilage or bone that supports a

median fin ray or spine

- Pyloric caecae: finger-like pouches connected with the alimentary canal (the gut)

R

- Ramus: one branch or one half of the jaw
- Ray: a jointed rod which supports a fin
- Retrose: turned backward
- Rostrum: a projecting snout or beak
- Rugose: rough

S

- Scalation: pertains to the pattern/arrangement/presence of scales
- Scute: any external horny or bony plate
- Serrate: notched like a saw
- Setae: bristles or hairs
- Soft dorsal: the posterior part of the dorsal fin which is composed of jointed rays
- Spatulate: shovel-like; having a broad, flat and rounded shape
- Spine: a sharp projecting point; an unjointed support in the anterior portions of the dorsal and anal fins
- Spinous, spiniform, spinate: spine-like or composed of spines
- Spinous dorsal: the anterior part of the dorsal fin supported by spines
- Spiracles: respiratory openings behind the eyes in sharks and rays
- Standard length (SL): the length of a fish measured from the tip of the snout to the posterior extremity of the hypurals, the expanded bones at the end of the backbone that support the caudal fin
- Submarginal: almost at the edge
- Suborbital: below the eye
- Superior: above or on the upper surface
- Supracleithrum: the bone forming a connection between the back of the skull and the pectoral girdle
- Supralateral: above the side
- Supramaxillary: a supplemental bone lying along the upper edge of the maxillary
- Supraocular: positioned above the eye
- Supraorbital: above the eye
- Supraorbital tentacle: a flap or filament of skin positioned above the eye
- Suprascapular: a bone uniting the shoulder girdle with the skull
- Suture: the line of union of two bones or plates
- Symphysis: point of junction of the two sides of the jaw
- Symmetrical: similarly arranged on both sides
- Swimbladder: a sac filled with gas, lying beneath the backbone

T

- Teleost: a member of Teleostei, an infraclass containing most of the bony fishes
- Terminal: at the end
- Tessellated: marked with little checks or squares, like tiles
- Thoracic: pertaining to the chest
- Thorax: the chest region, just behind the head
- Total length: the length from the tip of the snout to the tip of the tail
- Transverse: crosswise
- Trilobate: with three lobes
- Tricuspid: with three cusps or points
- Truncate: terminating abruptly, as if cut off square
- Trunk: the region of a fish between the head and tail, or the last gill slit and vent
- Tubercle: a small, usually hard excrescence or lump
- Tubiform, tubuliform: resembling a tube
- Type locality: the location from which the type specimen was collected.

U

- Undulated: waved
- Urogenital papilla: a papilla through which the urinary waste and gametes leave the body

V

- Vent: the external opening of the alimentary canal, the anus
- Ventral: pertaining to the abdominal or lower surface
- Ventral fins: paired fins behind or below the pectoral fins
- Vertical fins: fins on the median line of the body; the dorsal, anal, and caudal fins
- Vestigial: reduced, or very poorly developed
- Villiform teeth: small, slender teeth forming velvety bands
- Vomer: a bone forming the front part of the roof of the mouth
- Vomerine teeth: teeth on the vomer (see above)

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List of freshwater aquarium fish species

A vast number of species of fish have been successfully kept in the home aquarium. This list gives only some of the most commonly-kept species.

- Live-bearing
  - Guppies & mollies (Poecilia)
    - Guppy (Poecilia reticulata)
    - Endler's livebearer (Poecilia wingei)
    - Sailfin molly (Poecilia latipinna)
  - Platies & swordtails (Xiphophorus)
    - Southern platy (Xiphophorus maculatus)
    - Variable platy (Xiphophorus variatus)
    - Green swordtail (Xiphophorus hellerii)
- Egg-laying
  - Bichirs and reedfish (Polypteriformes)
    - Senegal bichir
  - Bonytongues (arowanas)
    - Asian arowana
    - Silver arowana
    - Arapaima
  - Catfish (Siluriformes)
    - Armored catfish (Callichthyidae)
      - *Aspidoras*
        - Aspidoras fuscoguttatus
        - Aspidoras lakoi
        - Aspidoras rochai
        - Sixray corydoras
      - *Brochis*
        - Britski's catfish
        - Emerald catfish
        - Hognosed brochis
      - *Callichthys*
        - *Callichthys callichthys*
      - *Corydoras*
        - Adolf's catfish
        - Banded corydoras
        - Bandit corydoras
        - Barredtail corydoras
        - Blackstripe corydoras

  - Blacktop corydoras
  - Blue corydoras
  - Bluespotted corydoras
  - Bronze corydoras
  - Corydoras atropersonatus
  - Corydoras ehrhardti
  - Corydoras evelynae
  - Corydoras geoffroy
  - Corydoras latus
  - Corydoras loxozonus
  - Corydoras nanus
  - Corydoras narcissus
  - Corydoras ornatus
  - Corydoras osteocarus
  - Corydoras polystictus
  - Corydoras prionotos
  - Corydoras semiaquilus
  - Corydoras septentrionalis
  - Corydoras simulatus
  - Corydoras undulatus
  - Dwarf corydoras
  - Elegant corydoras
  - False network catfish
  - False spotted catfish
  - Green gold catfish
  - Guapore corydoras
  - Masked corydoras
  - Mosaic corydoras
  - Panda corydoras
  - Pastaza corydoras
  - Peppered corydoras
  - Pink corydoras
  - Pygmy corydoras
  - Reticulated corydoras
  - Sailfin corydoras
  - Salt and pepper catfish
  - Schwartz's catfish
  - Spotted corydoras
  - Sterba's cory
  - Sychr's catfish
  - Tailspot corydoras
  - Threestripe corydoras
  - Xingu corydoras
- Armored suckermouth catfish (Loricariidae, aka

Plecos)

- Bristlenose catfish
  - Whiptail Catfish
  - Twig Catfish
  - Leopard catfish
- Common plecos
  - Liposarcus pardalis
  - Sailfin catfish
  - Suckermouth catfish
  - Suckermouthed catfish
- Zebra pleco
- Dwarf suckermouth catfish (Otocinclus)

- Glass catfish
- Iridescent shark
- Redtail catfish

○ Characins (Characidae)

- Black tetra
- Buenos Aires tetra
- Cardinal tetra
- Cave tetra
- Common hatchetfish
- Green neon tetra
- Neon tetra
- Serpae tetra
- Silver dollar

○ Cichlids (Cichlidae)

- Eartheater cichlid
- Firemouth cichlid
- Jack Dempsey
- Managuense cichlid
- Green terror
- Jewel cichlid
- Angelfish
- Discus
- Tropheus
- Electric yellow
- Red empress cichlid
- Red devil cichlid
- Oscar
- Red zebra
- Zebra tilapia

○ Cyprinids (Cyprinidae)

- Barbs
  - Arulius barb

  - Bigspot barb
  - Black ruby barb
  - Checker barb
  - Cherry barb
  - Clipper barb
  - Clown barb
  - Gold barb
  - Golden barb
  - Greenstripe barb
  - Melon barb
  - Onespot barb
  - Pentazona barb
  - Pool barb
  - Puntius partipentazona
  - Red line torpedo barb
  - Rosy barb
  - Shortfin barb
  - Sixband barb
  - Spanner barb
  - Spotted barb
  - Spottedsail barb
  - Swamp barb
  - Ticto barb
  - Tic-tac-toe barb
  - Tiger barb
  - Tinfoil barb
- Cold-water fish
  - Goldfish
  - Common carp
  - Koi
  - White Cloud Mountain minnow
- Daces
  - Common dace
- Danios
  - Bengal danio
  - Giant danio
  - Malabar danio
  - Pearl danio
  - Queen danio
  - Spotted danio
  - Turquoise danio
  - Zebra danio
- Rasboras
  - Harlequin rasbora

    - Rasbora pauciperforata
    - Rasbora vulcanus
    - Rasbora cf. taeniata
- Elephantnose fish (Gnathonemus petersii)
- Bala shark (Balantiocheilus melanopterus)
- Knifefish and eels (Gymnotiform)
  - Black ghost knifefish
- Labyrinth fishes (Anabantidae, Osphronemidae, Helostomatidae)
  - Blue gourami (Three spot gourami)
  - Siamese fighting fish
  - Kissing gourami
- Loaches (Cobitidae)
  - Burmese border loach
  - Clown loach
  - Yoyo loach
  - Dojo loach
  - Dwarf loach
  - Skunk loach
  - Horseface loach
  - Kuhli loach
  - Longnose loach
- Mormyridae
- Pufferfish (Tetraodontidae)
  - Giant freshwater pufferfish
  - Dwarf pufferfish
  - Figure 8 pufferfish

See also

- List of freshwater aquarium plant species

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List of freshwater aquarium invertebrate species

Invertebrates are commonly introduced into freshwater aquaria. There are several snail species, numerous shrimps, and crayfish that are found in aquaria. Some of these species are:

Shrimp

- Caridina cf. babaulti, green midget shrimp
  Caridina gracilirostris, redfronted shrimp
  Caridina cf. gracilirostris, white-nose Shrimp
  Caridina japonica, Japanese glass shrimp , Amano shrimp
  Caridina serrata, bumblebee shrimp , crystal red shrimp
  Caridina solearipes
  Caridina brevifrons
  Caridina sp., black midget shrimp
  Caridina serratirostris
  Caridina solearipes
  Caridina sp. tiger
  Macrobrachium lar
  Neocaridina denticulata
  Neocaridina denticulata sinensis, Taiwan pale blue shrimp
  Neocaridina denticulata sinensis var. red, cherry red shrimp
  Palaeomonetes, ghost (glass, grass) shrimp

Crayfish

- Procambarus alleni
  Procambarus species
  Cambarellus montezuema

Snails

- Pomacea canaliculata (apple snail)
  Corbicula fluminea

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List of freshwater aquarium plant species

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- 1 Introduction
- 2 Fake or pseudo-aquarium plants
- 3 Listed alphabetically by scientific name
- 5 See also

Introduction

Aquatic plants are used to give the aquarium a natural appearance, oxygenate the water, and provide habitat for fish, especially fry (babies) and for invertebrate species. Some aquarium fish and invertebrates also eat live plants. Recently, there has been a movement in the hobby to use aquatic plants as part of aesthetic aquarium design and aquascaping, spearheaded by Japanese aquarist Takashi Amano.

Most of these plant species are found either partially or fully submersed in their natural habitat. Although there are a handful of obligate aquatic plants that must be grown in water (*Cabomba* sp., for example), most grow and thrive fully emersed if the soil is kept moist.

Fake or pseudo-aquarium plants

Several species of land plants such as umbrella pine and aluminum plant (Pilea cadairei) are also frequently sold as "aquarium plants". While such plants are beautiful and can survive for some time under water, they will eventually die and must be removed so their decay does not contaminate the aquarium water.

Listed alphabetically by scientific name

As a very important note, the taxonomy of most aquatic plant genera is not final. Scientific names and classifications have changed often in the past years, creating confusion for most aquarists. Most of the old names are still in use today on some web sites.

Common aquarium plant species:

- Acorus calamus
  Acorus gramineus
  Aglaonema modestum
  Aglaonema simplex
  Alisma gramineum
  Alternanthera bettzichiana
  Alternanthera lilacina
  Alternanthera philoxeroides
  Alternanthera reineckii "rosaefolia"
  Alternanthera sessilis
  Ammannia gracilis
  Ammannia latifolia
  Ammania senegalensis
  Anubias afzelii
  Anubias barteri var. barteri
  Anubias barteri var. nana
  Anubias barteri var. nana 'Petite'
  Anubias congensis
  Anubias frazeri
  Anubias gilletti
  Anubias gracilis
  Anubias hastifolia
  Anubias heterophylla
  Anubias lanceolata
  Aponogeton appendiculatus
  Aponogeton bernierianus
  Aponogeton boivinianus
  Aponogeton capuronii
  Aponogeton crispus
  Aponogeton decartyi
  Aponogeton desertorum
  Aponogeton dioecus
  Aponogeton distachyos
  Aponogeton elongatus

Aponogeton fenestralis
Aponogeton henkelianus
Aponogeton junceus
Aponogeton longiplumulosus
Aponogeton loriae
Aponogeton madagascariensis (Madagascar laceleaf, lace plant)
Aponogeton natans
Aponogeton rigidifolius
Aponogeton tenuispicatus
Aponogeton ulvaceus
Aponogeton undulatus
Armoracia aquatica
Azolla caroliniana
Azolla filiculoïdes
Azolla pinnata
Bacopa amplexicaulis
Bacopa australis
Bacopa caroliniana (lemon bacopa, water hyssop)
Bacopa crenata
Bacopa monnieri (water hyssop)
Bacopa myriophylloides
Bacopa rotundifolia
Baldellia ranunculoides
Barclaya longifolia
Barclaya motleyi
Blyxa aubertii
Blyxa echinosperma
Blyxa japonica
Blyxa novoguineensis
Blyxa octandra
Bolbitis heteroclita
Bolbitis heudelotii
Cabomba aquatica
Cabomba caroliniana
Cabomba furcata
Cabomba palaeformis
Caldesia parnassifolia
Calla palustris
Callitriche hamulata
Callitriche hermaphroditica
Callitriche palustris
Callitriche stagnalis
Cardamine lyrata
Cardamine rotundifolia

Ceratophyllym demersum
Ceratophyllum submersum
Ceratopteris cornuta
Ceratopteris pteridoides
Ceratopteris thalictroides
Chlorophytum bichetii
Cladophora aegagropila
Crassula aquatica
Crassula helmsii
Crinum calamistratum
Crinum natans
Crinum purpurascens
Crinum thaianum
Cryptocorine moehlmanni
Cryptocoryne affinis
Cryptocoryne alba
Cryptocoryne albida
Cryptocoryne aponogetifolia
Cryptocoryne auriculata
Cryptocoryne axelrodii
Cryptocoryne balansae
Cryptocoryne beckettii 'petchii'
Cryptocoryne blassii
Cryptocoryne bogneri
Cryptocoryne bullosa
Cryptocoryne ciliata
Cryptocoryne cognata
Cryptocoryne cordata
Cryptocoryne crispatula
Cryptocoryne cruddasiana
Cryptocoryne diderici
Cryptocoryne elliptica
Cryptocoryne ferruginea
Cryptocoryne fusca
Cryptocoryne grabowskii
Cryptocoryne gracilis
Cryptocoryne griffithii
Cryptocoryne huegelii
Cryptocoryne legroi
Cryptocoryne longicauda
Cryptocoryne lucens
Cryptocoryne lutea
Cryptocoryne minima
Cryptocoryne nevillii

Cryptocoryne nurii
Cryptocoryne parva
Cryptocoryne petchii
Cryptocoryne pontederiifolia
Cryptocoryne purpurea
Cryptocoryne retrospiralis
Cryptocoryne siamensis
Cryptocoryne spiralis
Cryptocoryne thwaitesii
Cryptocoryne tonkinensis
Cryptocoryne undulata
Cryptocoryne usteriana
Cryptocoryne venemae
Cryptocoryne versteegii
Cryptocoryne walkeri
Cryptocoryne wendtii 'Tropica'
Cryptocoryne willisii
Cryptocoryne zewaldae
Cryptocoryne zonata
Cryptocoryne zukalii
Cyperus alternifolius
Cyperus helferi
Cyperus papyrus
Damasonium alisma
Dracaena sanderiana
Didiplis diandra
Echinodorus africanatus
Echinodorus amazonicus
Echinodorus andrieuxii
Echinodorus angustifolius
Echinodorus argentinensis
Echinodorus aschersonianus
Echinodorus barthii
Echinodorus berteroi
Echinodorus bleheri
Echinodorus bolivianus
Echinodorus brevipedicellatus
Echinodorus cordifolius (spade leaf sword)
Echinodorus fluitans
Echinodorus grandiflorus
Echinodorus horemanii
Echinodorus horizontalis
Echinodorus humilis
Echinodorus latifolius

Echinodorus longiscapus
Echinodorus macrophyllus
Echinodorus martii
Echinodorus opacus
Echinodorus osiris
Echinodorus 'Ozelot'
Echinodorus palaefolius
Echinodorus paniculatus
Echinodorus parviflorus
Echinodorus pelliscidus
Echinodorus quadricostatus
Echinodorus radicans
Echinodorus rigidifolius
Echinodorus 'Rubin'
Echinodorus rubra
Echinodorus schlueteri
Echinodorus subalatus
Echinodorus tenellus
Echinodorus tunicatus
Echinodorus uruguayensis
Egeria densa
Egeria naias
Eichhornia crassipes
Eichhornia diversifolia
Elatine hydropiper
Elatine macropoda
Eleocharis acicularis
Eleocharis dulcis
Eleocharis minima
Eleocharis obtusa
Eleocharis parvula
Eleocharis vivipare
Elodea canadensis
Elodea nuttallii
Elodea occidentalis
Eriocaulo sp.
Eusteralis stellata
Fittonia argyroneura
Fontinalis antipyretica
Glossadelphus zollingeri
Glossostigma diandrum
Glossostigma elatinoides
Gymnocoronis spilanthoides
Hemianthus callitrichoides

Hemianthus micranthemoides
Hemigraphis colorata
Heteranthera dubia
Heteranthera reniformis
Heteranthera zosterifolia
Hippuris vulgaris
Hottonia inflata
Hottonia palustris (water violet)
Hydrilla verticillata
Hydrocharis morsus-ranae
Hydrocleis nymphoides
Hydrocotyle leucocephala
Hydrocotyle sibthorpioides
Hydrocotyle verticillata
Hydrocotyle vulgaris
Hydrothrix gardneri
Hydrotriche hottoniiflora
Hygrophila augustifolia
Hygrophila corymbosa 'siamensis'
Hygrophila difformis (water wisteria)
Hygrophila guianensis
Hygrophila lacustris
Hygrophila lancea
Hygrophila natalis
Hygrophila polysperma
Hygrophila salicifolia
Hygroryza aristata
Isoetes lacustris
Isoetes malinverniana
Isoetes velata
Isolepis setracea
Juncus repens
Lagarosiphon madagascariensis
Lagarosiphon major
Lagenandra insignis
Lagenandra koenigii
Lagenandra lancifolia
Lagenandra nairii
Lagenandra ovata
Lagenandra thwaitesii
Lemna gibba
Lemna minor
Lemna paucicostata
Lemna perpusilla

Lemna trisulca
Lilaeopsis brasiliensis
Lilaeopsis carolinensis
Lilaeopsis macloviana
Lilaeopsis mauritiana
Lilaeopsis novae zelandiae
Lilaeopsis ruthiana
Limnobium laevigatum
Limnobium spongia
Limnocharis flava
Limnophila aquatica
Limnophila aromatica
Limnophila glabra
Limnophila heterophylla
Limnophila indica
Limnophila sessiflora
Limnophila sessiliflora
Lindernia rotundifolia
Littorella uniflora
Lobelia cardinalis (cardinal flower)
Lobelia dortmanna
Ludwigia alternifolia
Ludwigia arcuata
Ludwigia glandulosa
Ludwigia helminthorrhiza
Ludwigia inclinata
Ludwigia inclinata var. verticellata 'Cuba'
Ludwigia mullertii
Ludwigia natans
Ludwigia palustris
Ludwigia pulvinaris
Ludwigia repens
Luronium natans
Lycopodium inundatum
Lysimachia nummularia (moneywort)
Marsilea crenata
Marsilea drummondii
Marsilea hirsuta
Marsilea pubescens
Marsilea quatrifolia
Mayaca fluviatilis
Mayaca vandellii
Micranthemum umbrosum
Microsorum pteropus (Java fern)

Monosolenium tenerum
Myriophyllum alterniflorum
Myriophyllum aquaticum
Myriophyllum elatinoides
Myriophyllum heterophyllum
Myriophyllum hippuroides
Myriophyllum matogrossense
Myriophyllum proserpinacoides
Myriophyllum scabratum
Myriophyllum spicatum
Myriophyllum tuberculatum
Myriophyllum ussuriense
Myriophyllum verticillatum
Myriophylumm oguraense
Najas graminea
Najas guadelupensis
Najas indica
Najas marina
Najas minor
Najas pectinata
Nesaea crassicaulis
Nitella capillaris
Nitella flexilis
Nitella gracilis
Nomaphila siamensis
Nomaphila stricta
Nuphar advenum
Nuphar japonica
Nuphar luteum
Nuphar pumilum
Nuphar sagittifolium
Nymphaea alba
Nymphaea lotus
Nymphaea micrantha
Nymphaea pubescens
Nymphaea pygmea
Nymphaea stellata
Nymphaea zenkeri 'lotus'
Nymphoides aquatica
Nymphoides humboldtiana
Nymphoides indica
Nymphoides peltata
Ophiopogon japonicus
Orontium aquaticum

Ottelia alismoides
Ottelia mesenterum
Ottelia ulvifolia
Phyllanthus fluitans
Pilularia americana
Pilularia globulifera
Pistia stratiotes
Pogostemon helferi
Pogostemon stellatus
Pontederia cordata
Potamogeton coloratus
Potamogeton crispus
Potamogeton densus
Potamogeton filiformis
Potamogeton gayi
Potamogeton gramineus
Potamogeton lucens
Potamogeton malaianus
Potamogeton natans
Potamogeton perfoliatus
Proserpinaca palustris
Ranunculus aquatilis
Ranunculus limosella
Regnellidium diphyllum
Riccia fluitans
Ricciocarpus natans
Rorippa aquatica
Rotala indica
Rotala macrandra
Rotala rotundifolia
Rotala wallichii
Ruppia maritima
Sagittaria chapmani
Sagittaria eatonii
Sagittaria filiformis
Sagittaria graminea
Sagittaria guyanensis
Sagittaria isoëtiformis
Sagittaria latifolia
Sagittaria microfila
Sagittaria montevidensis
Sagittaria natans
Sagittaria papillosa
Sagittaria platyphylla

Sagittaria pusilla
Sagittaria sagittifolia
Sagittaria subulata
Salvinia auriculata
Salvinia cucullata
Salvinia minima
Salvinia natans
Salvinia oblongifolia
Salvinia rotundifolia
Samolus floribundus
Samolus parviflorus
Samolus valerandi
Saururus cernuus
Selaginella sp.
Shinnersia rivularis
Spathiphyllum wallisii
Spiranthes romanzoffiana
Spirodela polyrhiza
Stratiotes aloides
Subularia aquatica
Syngonium podophyllum
Synnema triflorum
Taxiphyllum barbieri
Tonina fluviatilis
Trapa natans
Triglochin maritima
Triglochin palustre
Triglochin striata
Typha angustifolia
Typha latifolia
Utricularia gibba
Utricularia graminifolia
Utricularia minor
Utricularia vulgaris
Vallisneria americana
Vallisneria asiatica
Vallisneria gigantea
Vallisneria neotropicalis
Vallisneria rubra
Vallisneria spiralis
Vallisneria tortissima
Versicularia dubyana (Java moss)
Wolffia arrhiza
Wolffia microscopica

Wolffiella floridana
Zannichellia palustris

See also

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List of marine aquarium fish species

The following is a list of marine aquarium fish species commonly available in the aquarium trade. It is not a completely comprehensive list; certain rare specimens may sometimes be available commercially yet not be listed here. A brief section on each, with additional links is provided.

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Angelfish

`(dwarf angels in a reef setting has been heavily debated)`

Common name	Reef safe	Care Level	Description
Bellus Angel		Moderate	
Blue Angelfish		Difficult	
Coral Beauty Angel		Easy to Moderate	
Cortez Angelfish		Moderate	
Eibli Angel		Easy to Moderate	
Emperor Angelfish		Moderate	
Flame Angel		Easy to Moderate	
Flameback Angel		Moderate	
French Angel		Difficult	
Half-Black Angel		Difficult	
Herald's Angel		Moderate	
Koran Angel		Moderate	
Lemonpeel Angel		Difficult	
Majestic (Blue-Girdled) Angel		Difficult	
Midnight Angel		Difficult	
Potter's Angel		Easy to Moderate	
Pygmy Angelfish		Moderate	
Queen Angel		Moderate	
Rusty Angel		Difficult	
Swallowtail Angel		Moderate	

Anthias

Common name	Reef safe	Care Level	Description
Bartlett's Anthias		Difficult	
Squareback Anthias		Difficult	

Bass

Common name	Reef safe	Care Level	Description
Chalk Bass		Easy to Moderate	
Harlequin Bass		Easy to Moderate	
Tobacco Bass		Easy to Moderate	

Basslets

This category also includes the spiny basslets.

Black cap basslet	Moderate	
Blue assessor or Blue devilfish	Easy to Moderate	(a spiny basslet)
Royal gramma	Easy to Moderate	
Yellow flavissimus assessor or Yellow devilfish	Easy to Moderate	(a spiny basslet)

Batfish

Common name	Reef safe	Care Level	Description
Orbiculate batfish	No	Difficult	
Teira batfish	No	Difficult	

Blennies

(excluding fang blennies, a few species will nip at polyps and giant clam mantles)

Common name	Reef safe	Care Level	Description
Barnacle / Spineyhead Blenny		Moderate	
Bicolor Blenny		Easy to Moderate	
Black Lined Fang Blenny		Easy to Moderate	
Bundoon Blenny		Easy to Moderate	
Canary Fang Blenny		Easy to Moderate	
Lawnmower Blenny		Easy to Moderate	
Midas Blenny		Easy to Moderate	
Red Lip Blenny		Easy to Moderate	
Red Sea Mimic Blenny		Moderate	
Sailfin Blenny		Moderate	
Tail Spot Blenny		Moderate	
Two-Spot Blenny		Moderate	

Boxfish

Boxfish generally are very personable fish yet are poorly suited for the home aquaria. They are not thought of as an ordinary aquarium tank mate, but are quickly gaining popularity. They do pose a hazard in the community tank however. They are capable of releasing a very powerful toxin which can kill other fish and in some cases, the boxfish itself. They generally only use it when threatened or dying, but can become disturbed easily with aggressive tank mates or overcrowded aquarium. Generally boxfish are not reef safe.

Common name	Reef safe	Care Level	Description
Helmet cowfish	No	Expert	
Longhorn cowfish	No	Expert	
Cubicus boxfish	No	Expert	

Butterflyfish

Common name	Reef safe	Care Level	Description
Copperband Butterfly		Difficult	
Heniochus Butterfly		Moderate	
Longnose Butterfly		Moderate	
Raccoon Butterfly		Moderate	

Cardinalfish

Common name	Reef safe	Care Level	Description
Bangaii / Kaudern's Cardinal		Moderate	
Flame Cardinal		Difficult	
Orange-Striped Cardinal		Difficult	
Pajama / Spotted Cardinal		Moderate	

Chromis

Common name	Reef safe	Care Level	Description
Blackmouth bicolor chromis	Yes	Difficult	Aggressive
Black and white Chromis	Yes	Moderate	Peaceful; likes acropora coral
Black bar Chromis	Yes		Usually peaceful unless housed alone
Blue reef chromis	Yes	Difficult	Peaceful and schooling
Green reef Chromis	Yes	Easy	Peaceful and schooling
Limbaughi chromis	Yes	Easy	Peaceful
Orange line chromis	Yes	Easy	Peaceful
Sunshine chromis	Yes	Easy	

Clownfish

Clownfish are a marine aquarium species noted for their ability to host in anemones. They have been recently popularized by the movie, Finding Nemo.

Common name	Reef safe	Care Level	Description
Cinnamon or Coral Sea clown	Yes	Easy to moderate	?
Clark's anemonefish	Yes	Easy to moderate	?
False percula clown	Yes	Easy	Commonly available. Also sold in a black color variation.
Maroon clown	Questionable	Easy to moderate	Can grow quite large and become aggressive towards smaller tankmates
Percula clown	Yes	Easy to moderate	Almost indistinguishable from A. ocellaris. Most Percula clowns sold are actually A. ocellaris.
Pink skunk clown	Yes	Moderate	?
Tomato clown	Yes	Easy	commonly available

Damsels

(sometimes excluding larger, more aggressive Dascyllus varieties)

Common name	Reef safe	Care Level	Description
Azure Damsel		Easy	
Blue Damsel		Easy	Also has an orange tail variant
Blue and gold damsel			
Blue velvet damsel			
BlueFin Damsel		Easy	
Domino Damsel		Easy	
Fiji Blue Devil Damsel		Easy	
Four stripe Damsel			
Garibaldi Damsel		Easy to Moderate	
Honey head damsel			
Jewel Damsel		Easy	
Lemon / Yellow Damsel		Easy	
Marginated Damsel			
Neon Damsel			
Orangetail Damsel		Easy	
Pink Smith Damsel		Easy	
Sergeant major damsel		Easy	
Springer's Damsel		Easy	
Stark's Damsel		Easy	
Talbots damsel			
Three Stripe Damsel		Easy	
Tuxedo Damsel			
Two Stripe Damsel			
Yellow Damsel			

Yellowtail Dascyllus	
Yellowtail Damsel	Easy

Dottybacks

See Pseudochromis

Dragonets

Common name	Reef safe	Care Level	Description
Mandarinfish	Yes	Difficult	A brightly colored member of the dragonet family. Eats only copepods and will die in captivity without an adequate supply, which can only be had in very large, well established reef tanks
Red scooter blenny	Yes	Moderate	Not a true blenny
Scooter blenny	Yes	Moderate	Not a true blenny

Eels

Common name	Reef safe	Care Level	Description
Golden Moray Eel		Difficult	
Snowflake Eel		Easy to Moderate	

Filefish

Common name	Reef safe	Care Level	Description
Fantail orange filefish	No	Easy	
Colored filefish	Caution	Easy	
Tassle filefish	Caution	Easy	
Clown filefish	Caution	Easy	

Foxface

See Rabbitfish

Gobies

Common name	Reef safe	Care Level	Description
Black clown goby	Mostly	Moderate	Similar to Yellow clown goby, but black
Citron clown goby	Mostly	Moderate	Can grow to up tp 3 inches in length
Engineer goby	Yes	Easy to Moderate	small burrowing goby
Green banded goby	Yes	Moderate	small burrowing goby with green vertical stripes
Red headed goby	Yes	Moderate	?
Watchman goby	Yes	Moderate	A perching goby that can form a symbiotic relationship with pistol shrimp
Yashia goby	Yes	?	?
Yellow clown goby	Yes	Moderate	small yellow fish that likes branching corals

Groupers

Common name	Reef safe	Care Level	Description
Panther grouper or Spotted grouper	No	Difficult	Will grow to 20 inches in length. Requires a fish only tank of about 300 gallons.
Blue dot grouper		Moderate	
Blue line grouper		Moderate	
Golden stripe soapfish		Moderate	
Leaflip grouper		Moderate	
Miniatus grouper		Moderate	
Red flag grouper		Moderate	
Red louti grouper		Moderate	
Spotted grouper		Moderate	

Hawkfish

Common name	Reef safe	Care Level	Description
Arc Eye Hawkfish		Moderate	
Flame Hawkfish		Easy to Moderate	
Longnose Hawkfish		Moderate	
Spotted Hawkfish		Easy to Moderate	

Hogfish

Jawfish

Jawfish are burrowers and require a sandy substrate of sufficient depth.

Common name	Reef safe	Care Level	Description
Black cap jawfish	Caution	Moderate	Requires a 30 gallon tank and 3 inch substrate. Tank should remain tightly lidded. May eat small shrimp.
Dusky jawfish	Caution	Moderate	Requires a 30 gallon tank and 3 inch sand substrate. Tank should remain tightly lidded.
Yellowhead jawfish	Caution	Moderate	Requires a 30 gallon tank and 5 to 7 inch soft substrate. Tank should remain tightly lidded.

Lionfish

Lionfish have poisonous spines and should be treated with caution.

Common name	Reef safe	Care Level	Description
Colored volitan lionfish		Easy to Moderate	
Fuzzy dwarf lion		Very Difficult	
Volitan lionfish	Caution	Easy to Moderate	Semi-aggressive; carnivore; Can grow up to 38cm in length in captivity

Pipefish

(can be killed by stinging corals and anemones)

Pufferfish

Common name	Reef safe	Care Level	Description
Dogface Puffer		Moderate	
Green Spotted Puffer		?	
Porcupine Puffer	corals:yes inverts:no	Moderate	
Black-spotted Porcupinefish		Moderate	
Sharpnose Puffer		Difficult	
Valentine Puffer		Moderate	

Pseudochromis

Common name	Reef safe	Care Level	Description
Australian multicolor pseudochromis		Moderate	
Blue flavivertex pseudochromis		Moderate	
Neon pseudochromis, Arabian dottyback or Neon dottyback		Moderate	
Bicolor pseudochromis		Easy to Moderate	resembles Royal gramma in coloration
Purple stripe pseudochromis or Diadema basslet		Easy to Moderate	
Indigo dottyback		Moderate	
Fridmani pseudochromis or Orchid dottyback		Easy to Moderate	
Sailfin pseudochromis		Moderate	
Splendid pseudochromis		Moderate	
Springeri pseudochromis		Moderate	
Strawberry pseudochromis or Purple psuedochromis		Easy to Moderate	

Rabbitfish

Common name	Reef safe	Care Level	Description
Foxface		Easy to Moderate	
Magnificent Foxface		Easy to Moderate	
Rabbitfish		Easy to Moderate	

Rays

All rays have a poisonous spine near the base of the tail. Care must be taken to avoid this animal when performing tank maintenance and during capture.

Common name	Reef safe	Care Level	Description
Fiddler stingray	No	Expert	Requires a minimum 360 gallon aquarium with a 1 meter width and a fine grained substrate. Coarse substrates may damage the underside of this animal, causing infection.
Round stingray	No	Expert	Requires a minimum 180 gallon aquarium and a fine grained substrate. Coarse substrates may damage the underside of this animal, causing infection.
Spotted Caribbean stingray	No	Expert	Requires a minimum 180 gallon aquarium and a fine grained substrate. Coarse substrates may damage the underside of this animal, causing infection.
Thornback stingray	No	Expert	Requires a minimum 360 gallon aquarium

with a 1 meter width

Seahorse

Seahorses are delicate animals with specialized care requirements. They require branching corals or other decorations in which to roost, and they are slow eaters, starving in the presence of more voracious tankmates. Additionally, wild caught seahorses do not always adapt well to captivity, so captive bred specimens are preferred.

Seahorses can be killed by stinging corals and anemones.

Common name	Reef safe	Care Level	Description
Black seahorse	Caution	Difficult	
Colored seahorse	Caution	Difficult	
Black seahorse	Caution	Difficult	

Squirrelfish

Tangs

Common name	Reef safe	Care Level	Description
Achilles Tang		Difficult	
Atlantic Blue Tang		Moderate	
Blonde Naso Tang		Easy to Moderate	
Bristletooth Tang		Easy to Moderate	
Chocolate Tang		Easy to Moderate	
Desjardini Tang		Moderate	
Eibli Mimic Tang		Moderate	
Hippo Tang		Moderate	
Kole Tang		Easy to Moderate	
Mimic Tang		Easy to Moderate	
Naso Tang		Easy to Moderate	
Powder Blue Tang		Moderate	
Purple Tang		Easy to Moderate	
Sailfin Tang		Easy to Moderate	
Scopas Tang		Easy to Moderate	
Yellow Tang		Easy to Moderate	

Tilefish

Though often categorized as Gobies, *Tilefish* are a separate species.

Common name	Reef safe	Care Level	Description
Blue-Headed Tilefish		Easy to Moderate	
Purple Tilefish		Easy to Moderate	
Skunk Tilefish		Easy to Moderate	

Triggerfish

Common name	Reef safe	Care Level	Description
Blue Jaw Trigger		Moderate	
Blue Line Trigger		Moderate	
Clown Trigger		Easy to Moderate	
Hawaiian Black Trigger		Moderate	
Niger Trigger		Easy to Moderate	
Picasso Trigger		Easy to Moderate	
Pinktail Sargassum Trigger		Moderate	

Wrasse

Some wrasse species are agressive towards small fish and invertebrates.

Common name	Reef safe	Care Level	Description
Carpenter's Fairy Wrasse		Difficult	
Eight Line Wrasse		Easy to Moderate	
Exquisite Fairy Wrasse		Difficult	
Fine-Spotted Fairy Wrasse		Difficult	
Four Line Wrasse		Easy to Moderate	
Greenback Fairy Wrasse		Difficult	
Harlequin Tusk		Moderate	
Multicolor Velvet Wrasse		Moderate	
Potter's Wrasse		Difficult	
Red-Head Fairy Wrasse		Difficult	
Six Line Wrasse	Yes	Easy to Moderate	small purple fish with six dark horizontal lines

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Live rock

Live rock is a term used in aquaria to describe rock from the ocean introduced into a salt water aquarium, which confers to the closed marine system muliple benefits desired by the salt water marine hobbyist. The name sometimes leads to misunderstandings as "live rock" is itself not actually alive, but is made simply from the calcium carbonate skeletons of long dead corals, or other calcareous organisms, which in the ocean form the majority of coral reefs. When taken from the ocean it is usually encrusted with Coralline and inhabited by a multitude of marine organisms. The many forms of micro and macroscopic marine life that live on and inside of the rock, and which acts as an ideal habitat, give it name "live rock."

Purpose of Live Rock

For the aquarium trade this rock is highly valued not only for the diversity of life it can bring to the closed marine environment, but its function as a superior biological filter that hosts both aerobic and anaerobic nitrifying bacteria required for the nitrogen cycle that processes waste. Live rock becomes the main biological nitrification base or biological filter of a saltwater aquarium. Additionally, "live rocks" have a stablizing effect on the water chemistry, in particular on helping to maintain constant pH by release of calcium. Lastly, live rock, especially when encrusted with multiple colors of coralline algae, becomes a major decorative element of the aquarium and provides shelter for the inhabitants. It's often used to build caves, arches, overhangs, or other structures in the tank, an art known as aquascaping.

Live rock is harvested for use in the aquarium trade from collections in the wild near reefs, where parts may become detached from the main body of coral by storms. Or it may be from small coralline rocks which are "seeded" by an aquaculturalist in warm ocean water, to be harvested later. Live rock can also be seeded by adding base rock to an active reef aquarium that already has live rock. Live rock harbors a wide variety of corals, algae, sponges, and other invertebrates, when they are collected. Not all of these are desirable, and through a process known as *curing*, live rock is usually kept in dark, closed lid tank for several weeks where most of the life on the rock, which would not survive in an aquarium, dies off. During this time there is also attempt to remove all undesirable animals, often hiding in the rock, before its placed in a display aquarium. Corals added later will often be attached to live rocks.

There are different types of live rock. In J. Charles Delbeek's article "Your First Reef Aquarium", published in Aquarium USA in 1994, under the Live Rock section he refers to "reef rock" basically as pieces of coral or coral rock from outside the reef that have broken off and fallen to the bottom that then becomes covered with encrusting organisms, such as coraline algae and sponges. "Inshore rock" Delbeek refers to as rock from inside the reef that has a tendency to be more dense and becomes covered with macroalgae, clams, mussels, crabs, shrimps, and other unwanted organisms. In Delbeek's view, this more pourous reef rock is preferable to the more dense inshore rock because it cycles an aquarium more quickly.

Explaining the purpose live rock in an aquarium, Delbeek: "The use of live rock immediately introduces into the aquarium numerous algae, bacteria and small invertebrates all of which contribute to the overall quality of the aquarium water. Live rock has just as much, if not more, surface area for bacteria than a trickle filter. Since live rock in the aquarium contains various types of bacteria, algae and corals, waste products such as ammonia, nitrate and phosphate can have a number of fates. Ammonia, nitrate and phosphate are readily assimilated by algae and photosynthetic corals growing on and in the rock. Ammonia can also be quickly converted into nitrate by the bacteria on and in the rock. This nitrate can be either absorbed by the algae and corals, or it can be denitrified by bacteria in close proximity to the nitrate producing bacteria." [1][[sv:Levande savannah]]

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Marine aquarium

A **marine aquarium** is an aquarium that keeps marine plants and animals in a contained environment. Marine aquaria are further subdivided into fish only (FO), fish only with live rock (FOWLR), or reef aquariums. Marine fishkeeping is different from its freshwater counterpart because of its complexity; the marine environment is more difficult to maintain, requiring more equipment and time from the hobbyist, and the aquarium inhabitants are often more expensive to acquire. Saltwater aquarium enthusiasts are also major contributors to the vast scientific knowledge shared within the hobby.

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Marine fishkeeping history

The very first saltwater tanks were glass jars where the Romans kept anemones outside but were very short lived. The first personal saltwater fishkeeping began on a wider scale in the 1950's, starting with the basic rectangular glass aquariums (usually 20 gallon), still popular today. Bleached coral along with a substrate of coarse crushed coral was the norm. Algae, including beneficial such as coralline, were viewed negatively and generally removed. The clean, sterile tank was viewed as the healthiest.

During the beginning days of marine aquaria, saltwater was initially collected at local beaches. Natural saltwater contains many unwanted organisms, along with the occasional unwanted pollutant. Aquarium literature of the time suggests that the most commonly kept marine fish of the day were the Percula Clownfish, Sergeant Major Damselfish, small, brackish pufferfish and scat, Jeweled Blennies, Sailfin Mollies, and Blue Damsels. Aquariums were equipped with large air compressors, and were heavily aerated and filtered (primarily with undergravel filters, a norm for some time).

Later in the hobby, air driven, counter-current protein skimmers were invented and revolutionized in Germany along with the Eheim pump company. Perhaps the largest revolution in fishkeeping was a more reliable submersible electric heater, invented by Eugen Jäger. Even today, *Jäger* is still a major company in aquarium heating.

Various initial aquarists attempted to find the chemical properties of sea water and mix in necessary trace elements to create synthetic salt mixes. Perhaps the first and undoubtedly the largest synthetic sea salt company was Instant Ocean. This revolutionized marine fishkeeping in landlocked areas instead of restricting it to areas near sources of seawater.

Various advancements in filtration included the trickle and hang-on filters, both allowing a more natural equilibrium to the aquarium environment. The advancement of fluorescent lighting technologies into higher outputs along with metal halide lighting established the reef tank, making it a possible to keep corals and invertebrates without natural sunlight.

More efficient chemical testing and more advanced knowledge allowed aquarists to have an idea about the chemical conditions and properties of aquariums. The biological establishment and understanding of maintaining an artificial ocean environment brought more successful and widespread marine fishkeeping. In the 1980's, the multitude of aquarium publications had greatly increased, and general chemical and biological knowledge was more widespread.

Modern fishkeeping

Marine Aquarium Components

The major components of a marine aquarium are a tank, usually composed of glass or acrylic, a stand, components necessary for chemical, mechanical, and biological filtration, lighting, and an apparatus used to heat the aquarium, usually an aquarium heater. Marine Aquariums can range anywhere from a tiny, nano reef aquariums to gigantic aquariums in surplus of 300 U.S. gallons (1200 L). Nano tanks are usually between 2.5 and 30 US gallons (10 and 120 L). These tanks are difficult to maintain due to the highly variable chemical properties of saltwater. It is usually easier to make mistakes with a highly concentrated body of water. However, large tanks, on the contrary, while easier to maintain on the biological and chemical level, are usually a financial impossibility for most individuals. For this reason, most saltwater tanks are between 40 and 100 US gallons (160 and 400 L). The stand is usually made of wood: fish tanks filled with water are extremely heavy and need a very sturdy base (a 75 US gallon aquarium filled with water and substrate can weigh in surplus of 600 US pounds).

The new age of fishkeeping focuses on various components functioning in order to create a biologically stable environment. There are various orthodoxies of fishkeeping today. The basic varieties of tanks are fish only (FO), fish only with live rock (FOWLR—arguably the most popular) and the reef tank, containing corals, sea anemones, or other delicate invertebrates, using high powered fluorescent or metal halide lighting fixtures in order to acquire the needed light output.

Live rock

Live rock is rock that has been in the ocean, composed of limestone and decomposing coral skeleton, usually around a coral reef such as those around Fiji, and is usually covered with beneficial algae, coralline and tiny invertebrates and bacteria that are desirable in the aquarium. Some examples of the microfauna commonly found on live rock are crab, snail, feather dusters, brittle stars, sea stars, limpets, abalones, and an occasional sea urchins, anemones, coral, and sea sponge. Bristleworms are also common, most of which, while unattractive, are not harmful and are useful scavengers; some species can be pests, however. The addition of live rock is one of the best ways to ensure a healthy aquarium, as the rock provides a buffer to maintain high pH (8.0-8.3), alkalinity, and acid-neutralizing capacity. Alkalinity is often known by a rather confusing term, "carbonate hardness", or KH. This is usually measured in "degrees" (dKH) or meq/L.

The microfauna found on live rock are detrivores and herbivores (as they eat algae and fish waste), and provide fish with a natural, attractive shelter. Live rock usually arrives from online dealers as "uncured", and must be quarantined in a separate tank while undergoing the curing process, which involves the inevitable die-off of some of the rock's inhabitants and the subsequent production of undesirable ammonia and nitrite. Live rock that is already cured is available at most pet stores that cater to saltwater. Live sand is similar to live rock and is equally desirable.

Filtration

There are a multitude of filtration methods available to the modern aquarist. All methods use a combination of chemical, mechanical, and biological filtration. Common hang-on filters usually only offer chemical and mechanical filtration through mesh and carbon, which is not enough for the saltwater aquarium, although some hang-on filters have plates where bacteria can colonize and provide biological filtration as well. These plates should never be cleaned, as this would kill the bacteria colonies. Most filters are marked to provide which forms of filtration they accommodate.

Depending on what is in the tank, protein skimmers are also very useful in the reef tank. With a low bioload (not many animals in the tank) and hardy livestock, a protein skimmer may not be absolutely necessary, though it is never a detriment. A heavily stocked tank, corals, and other delicate animals may need a protein skimmer to survive.

Perhaps the most popular and widespread biological filter is the refugium. Water is drawn from the main tank to the refugium (usually a smaller container hidden behind or below the main aquarium), then is returned to the main tank. This smaller tank serves two purposes: it adds water volume (thus diluting any chemical problems), and it provides a place for biological filtration. Refugiums can also serve as a temporary shelter area for recovering injured fish, delicate animals that need to be slowly acclimated to the aquarium environment, and to temporarily separate fighting inhabitants. Refugiums often contain live rock and live sand, macroalgae, and scavenger microfauna such as micro brittle stars, tiny sea stars such as asterina, snails, and worms. Some people also use refugiums to raise tiny brine or mysis shrimp for delicate fish like seahorses and dragonets. A sump is a refugium that also contains the main aquarium's other equipment, to keep all hoses, filters, and heaters out of view. This is especially common for show tanks and reef tanks.

Lighting

Lighting is a controversial topic in fishkeeping. Most fish are not particular about lighting—the light is more for the aquarist than for the fish. However, a regular cycle of light and dark, simulating day and night, is beneficial for fish, since it establishes a routine and makes them feel more secure. Any light will do for a fish only (FO) tank. A fish only with living rock (FOWLR) tank will need a more powerful light to encourage the growth of coralline algae. There are many types of lights available; generally speaking, the higher the power rating in watts, the better. Some types include fluorescent, VHO fluorescent (Very High Output), compact fluorescent and metal halide. A powerful fluorescent lighting fixture may be enough for a fish only with living rock (FOWLR) system, depending on the depth and size of the aquarium. Coral reefs require more powerful lights, the general rule being 3 to 5 watts of power per gallon of water; research of particular species' needs before buying is essential. Metal halides are the most popular lighting fixture of reef aquariums, since they provide more light per lamp than fluorescent fixtures. Additionally, metal halide lamps produce light from a single "point source" and thus produce flickering "glimmer lines" on the aquarium floor, an effect prized by aquarists. Actinic lights produce a deep blue spectrum designed to simulate the dominant wavelength of light a few metres below the ocean's surface.

Recent advances in lighting technology have also made available a completely new technology in aquarium lighting; Light Emitting Diodes (LEDs). Although LEDs themselves are not new, the lighting temperature which used to very low on LEDs has now been able to increase to a point that LEDs can now be used as a viable alternative to gas and filament based lighting. LED lighting is still in its early stages and therefore very expensive, however there are several advantages that these lights bring over traditional lighting, barring the initial cost; they consume very little power, in being solid-state they have an exponentially longer lifespan- and do not need to be replaced, and because the "light fixture" is comprised of hundreds of small bulbs, these can installed and controlled by a microcomputer to slowly fade in and out to simulate day break and sunset, as well as having the ability to mix in special blue LEDs which can simulate the moon at night, also with the programmability of having the phases of the moon.

Heating

Most fishkeeping is tropical, and most fish gathered are caught in Africa, Southeast Asia, and the Red Sea. A temperature of 75 degrees Fahrenheit to 82 degrees Fahrenheit (24 °C to 28 °C) is the most common, reflecting the environment of the organisms. This generally necessitates the use of a heater, almost always fully submersible, though reef tanks with very powerful (and therefore hot) lights can actually require cooling in some locations. Cold water marine fishkeeping is generally only regional, and most cold water fish are caught locally. This is because the physical appearance of cold water fish is not as attractive or colorful as that of their warmer-water counterparts.

Water testing

The most common things to test for in a saltwater aquarium are:

Specific gravity should be kept between 1.020 and 1.024 for a fish only tank, and 1.023 and 1.026 for invertebrates and corals. Salinity should therefore be between 28-32 PPT. Salinity is directly related to specific gravity and both can be tested with a hydrometer, which is inexpensive but often imprecise. A more precise way of measuring the salinity is to use a refractometer which, once properly calibrated, offers greater precision.

pH should be maintained between 8.1 and 8.3 (can be raised with a commercially available buffer or through calcium-rich substrata); Carbonate hardness (KH) should be between 8 and 12 degrees. The best way to avoid KH and pH swings is to purify the water with a reverse osmosis / deionization (RO/DI) unit.

The nitrogen cycle refers to the conversion of toxic ammonia, to nitrite and finally nitrate. While fish waste (urine and feces), and decaying matter release ammonia, the majority of ammonia (approximately 60%) in both marine and freshwater aquariums is excreted directly into the water from a fishes' gills. Biological (bacterial) nitrification converts the ammonia into nitrite ions, NO_2-, and then to nitrate ions, NO_3-. Nitrate is readily taken up and assimilated by algae and hermatypic corals. Some nitrate can be converted by an anaerobic bacterial process to free nitrogen, but this process is very difficult to maintain. Most nitrate, which is less toxic to fishes and most invertebrates accumulates in the water until it is physically removed by a water change. Ammonia and nitrite should be tested regularly; any detectable levels (i.e., over 0 ppm) are indicative of a problem. Nitrate should not exceed 20ppm in reef tanks, or 40ppm in fish-only tanks. It is normal to have a little nitrate buildup, and some livestock handle it better than others. Most hermatypic corals, while able to assimilate nitrate, cannot be expected to perform well with chronically high nitrate concentrations (>40 mg/L as nitrate ion (~ 10 mg/L nitrate-nitrogen)).

Other suggested tests include calcium, alkalinity, iodine, strontium, molybdenum, and other trace minerals. Research the particular species you wish to keep to see if it is necessary for you to do additional testing.

Water changes

Water changes are a staple of good saltwater maintenance. It involves removing from 10% to 20% of the total volume of the aquarium, replacing that water with new pre-mixed saltwater. Pre-mixed saltwater has been dechlorinated and/or dechloraminated, brought to the temperature and salinity of the aquarium, and left in a mixing container (such as a bucket with a powerhead) for long enough to ensure that all the salts have been dissolved (typically several hours).

Replacement water should be of the same source as the aquarium, whether it be reverse osmosis, de-ionized, distilled or municipal supply, in order to avoid drastic changes in water chemistry. In cases where one is replacing a tap water-based salt mix with a reverse osmosis-based salt mix, the replacement water should be added slowly over the course of several hours to avoid sending the aquarium inhabitants into osmotic shock. If using municipal water, one should check with the local utility company to find out the composition of that tap water. Water containing high levels of nitrate or phosphate should be avoided, and reverse osmosis or distilled water used in its place.

Conservation

Almost all species kept in marine aquaria at this time are caught in the wild. Very few species, such as clownfish, are captive-bred on a commercial scale. Much collecting is done in Indonesia and the Philippines, where use of cyanide and other destructive collection methods is common. The majority of live rock is also harvested in the wild, and recent restrictions on this harvest in Florida have caused a shift to Fijian and aquacultured rock. Natural rock takes many years if not centuries to form, and is vital habitat for countless marine species, and thus, commercial-scale harvesting of naturally-occurring live rock has been criticized by conservationists. Additionally, many animals species sold to hobbyists have very specific dietary and habitat requirements that cannot be met by hobbyists (e.g. Labroides genus wrasses, the Moorish Idol); these animals almost inevitably die well before their time, and their color and appearance is poor. These issues are often downplayed by individuals and organizations with a financial interest in the trade. Hobbyists should be urged to buy only certified net-caught fish (although ensuring the legitimacy of such claims can be difficult) or captive-raised fish, as well as farmed corals and to support legitimate reef conservation efforts. It should be noted that the majority of corals can be "fragged", whereby a portion of a larger captive coral is separated and can subsequently be raised into an individual specimen, allowing for coral propagation withing the domestic aquarium; the trade in frags offers a fantastic opportunity for marine aquarists to obtain new and unique corals whilst limiting the effect on the natural environment. Rare species and those without a history of being successfully kept in captivity should be avoided.

Commercial front

Various businesses have brought a commercial front to fishkeeping, perhaps the largest being Marineland, Inc. Along with movies such as Finding Nemo, fishkeeping is becoming much more widespread than ever before. Perhaps the biggest turndown in fishkeeping is the initial cost. A 100 US gallon (400 L) reef tank full of coral and equipment can cost in excess of $5000 US. Aside from the difficulty, this is a large factor as to why freshwater fishkeeping is still so widespread in comparison to its marine counterpart.

References and further reading

- *The Conscientious Marine Aquarist*, by Robert Fenner
- *Invertebrates: A Quick Reference Guide*, by Julian Sprung
- *Corals: A Quick Reference Guide*, by Julian Sprung
- *Reef Invertebrates: An Essential Guide to Selection, Care and Compatibility*, by Anthony Calfo and Robert Fenner
- *Aquarium Corals : Selection, Husbandry, and Natural History*, by Eric H. Borneman
- *Natural Reef Aquariums: Simplified Approaches to Creating Living Saltwater Microcosms*, by John H. Tullock

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Painted fish

The term **painted fish** refers to ornamental aquarium fishes which have been artificially coloured to appeal to consumers. This artificial colouring, also known as **juicing**, is achieved by a number of methods, such as injecting the fish with a hypodermic syringe containing bright fluorescent colour dye, dipping the fish into a dye solution, or feeding the fish dyed food.

This process is usually done to make the fish a brighter color and more attractive to consumers. The coloring of the fish is not permanent, and usually fades away in six to nine months.

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- 2 Varieties
  - 2.1 Some commonly painted species
- 3 Health hazards to painted fish
- 4 Efforts to stop fish painting
- 5 References

Methods

Information on methodology is sometimes scanty. However, it is widely accepted that a common method is injection via syringe. Generally, fish are injected multiple times.[1]

Fish may also be dipped in a caustic solution to strip their outer slime coat, then dipped in dye. This method is reported to have a very high mortality rate.[2]

Many varieties of "colour-enhancing" foods for aquarium fishes are available to the consumer. Generally, these foods contain natural dyes such as beta carotene and are not harmful to fish, although as with other dye methods, the effect is temporary. One source reports that harmful dyes are sometimes used by wholesalers, however.[2]

Fish can also be tattooed using a low-intensity laser with a dye, a process developed for fisheries scientists but now applied to ornamental fish.[3]

It has been rumoured that some brightly colored "male" fishes in dealer tanks may actually consist of both males and females treated with hormones so all the fish, males and females alike, show male breeding colors even out of breeding season.[4]

Varieties

Some species, such as albino Corydoras and "painted" glassfish, are injected with dye using a hypodermic needle. In more recent times (2004-2005), injection dyed albino Plecostomus and rift lake cichlids have also become available. Other than the Indian Glassy Fish, most dyed fish are albinos.

Some commonly painted species

- Indian Glassy Fish (Parambassis ranga). Tradename: Painted glassfish; Disco Fish; Colored Glass Tetra.
- Black tetra (Gymnocorymbus ternetzi). Tradenames: Berry Tetra; Painted Tetra.
- Oscar (Astronautus ocellatus). Tradenames: Blueberry Oscar; Strawberry Oscar.
- Corydoras species
- African Rift Lake cichlids, such as Pseudotropheus. Tradenames: Ice Blue Albino Cichlid; Zebra Ice Albino Cichlid.
- Suckermouth catfish (Hypostomus plecostomus). Tradenames: Patriotic Suckerfish; Mixed Color Suckerfish.
- Parrot cichlid (Amphiliphus citrinellus x Heros severus). Tradenames: Jellybean Cichlid; Cotton Candy Cichlid.
- Goldfish (Carassius auratus). Tradenames: Jellybeans; Icepops. [5]

Health hazards to painted fish

Many dyed fish die during this stressful, painful, process and those that do survive often are susceptible to disease. For example, one source reports a 300% increase in diseases such as Lymphocystis, Ichthyophthirius and finrot in painted aquarium populations compared to unpainted populations, possibly due to infection by dirty syringes. In addition, fishes injected with dye often die without apparent external disease symptoms, presumably due to kidney disease caused by injection.[6]

Efforts to stop fish painting

Some members of the aquarium trade want to ban this practice. For example, the British publication Practical Fishkeeping started a campaign in 1996 to ask retailers to stop selling dyed fish, which led to a significant decrease in the number sold in the United Kingdom. Practical Fishkeeping has launched a similar campaign with a global scope and maintains a register of stores which do not stock dyed fish.[7] The Royal Society for the Prevention of Cruelty to Animals (RSPCA) regards the practice as cruel and unnecessary cosmetic mutilation. A campaign in Australia and in the UK has limited the sale of these fish. Dyed fish are still available and are generally imported from south-east Asia.

In February 2006, the UK's Department for Environment, Food and Rural Affairs (Defra) confirmed that it will not be making it illegal to sell dyed fish in the UK under the forthcoming Animal Welfare Bill.[8]

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Protein skimmer

A **protein skimmer** or **foam fractionator** is a device used mostly in saltwater aquaria to remove organic compounds from the water before they break down into nitrogenous waste. Protein skimming is the only form of filtration that physically removes organic compounds before they begin to decompose, lightening the load on the biological filter and improving the water's redox potential.

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Function

Protein skimming removes certain organic compounds, including proteins and amino acids, by using the polarity of the protein itself. Due to their intrinsic charge, water-borne proteins are attracted to the air/water interface. Protein skimmers work by injecting numerous tiny bubbles into the water column. The small bubbles present an enormous air/water interface for the protein molecules to cling to. The longer the bubble resides in the water, the more proteins it is able to attract. The action of a protein skimmer is often compared to the action of waves producing sea foam.

The term *protein skimming* is misleading because this form of filtration removes other substances besides proteins. These other substances include fats and fatty acids, carbohydrates, metals such as copper complexed with proteins, and certain trace elements such as iodide, in addition to particulates and other detritus, phytoplankton, and bacteria.

Although copper and other metals can be removed through protein skimming, the element is attached to organics, then removed with the organic. Fat can cause a skimmer foam to collapse, handicapping its efficiency.

Design

The basic skimmer design consists of a main chamber through which the water to be filtered flows. Air is injected into the column as fine bubbles. The surface of the bubbles collect proteins and other substances and carries them to the top of the device where a collection cup allows the foam to leave the main chamber. Here the foam condenses to a liquid, which is removed from the system. This material can range in color from a light tea to black tar.

Every skimmer operates either by co-current flow, in which the water flows upward in the column along with the bubbles, or by counter-current flow, in which the water flows downward against the direction of the bubbles. Counter-current skimmers are more efficient because of the greater contact time the water has with the bubbles.

Air stone

The original method of protein skimming, it is not completely obsolete, although many newer technologies have eclipsed this method. The air stone is a ceramic block with an air hose attached that runs to a small air pump. The stone is placed at the bottom of a tall column of water. The tank water is pumped into the column, allowed to pass by the rising bubbles, and back into the tank. To get enough contact time with the bubble, these units can be many feet in height. While this method has been around for many years, many regard it as inefficient for larger systems or systems with large bio-loads.

Downdraft

Pumped tank water enters through a small vertical column next to the main column, that contains a plastic media that shreds the water, entrapping air in to the stream. The result is a milky white appearance of very fine bubbles. The stream enters a mixing box and is allowed to rise within the reaction chamber. This skimmer design was popular for larger skimmers but has become less prevalent with the growth of needlewheel and Beckett skimmer.

Venturi

The premise behind these skimmers is that a venturi valve, or aspirator, can be used to introduce the bubbles into the water stream. The tank water is pumped through the venturi, in which fine bubbles are introduced, then enters the skimmer body. This method was popular due to its compact size and high efficiency but venturi designs are now more likely to be included in other skimmer designs rather than as a simple venturi design.

Needlewheel

This skimmer design is more correctly known as an aspirating skimmer, since many skimmers in this family do not use needlewheels (needlewheel describes the look of the modified water pump impeller which appears to have a number of needles sticking from it) but instead use an water pump impeller with a number of pegged rods protruding from it. The purpose of these modified impellers is to chop or shred the air that is introduced via a venturi or external air pump into very fine bubbles. This style skimmer has become very popular and is believed to be the most popular type of skimmer used with residential reef aquariums today. It has been particularly successful in smaller aquariums due to its usually compact size, ease of set up and use, and quiet operation.

Spray Induction

This method is related to the downdraft, but uses a pump to power a spray nozzle, fixed a few inches above the water level. The spray action entraps and shreds the air in the base of the unit, which then rises to the collection chamber.

Beckett

This type of skimmer uses a foaming jet fountain nozzle manufactured by the Beckett Corporation in a protein skimmer design similar to the downdraft skimmer. Instead of using plastic media to produce the needed small bubbles as in a traditional downdraft design, a Beckett skimmer uses the Beckett 1408 foam nozzle. A Beckett skimmer can use very powerful water pumps to produce great amounts of foam and the Beckett skimmer design is often used for protein skimmers for large reef aquariums. Some larger Beckett skimmers are designed with 2 or more Beckett injectors and can use multiple water pumps to further improve the amount of foam produced and support even larger aquariums or further reduce the level of dissolved organic compounds in the aquarium. Beckett skimmers have borrowed from both downdraft and venturi designs (the Beckett foam head is a modified 4 port venturi) to produce a hybrid that may be more effective than it's predecessors. However, while they can be quite powerful, Beckett skimmer designs requirement for powerful water pumps to take full advantage of their foam producing ability can mean that they sometimes use more electricity and may produce more noise than the smaller water pumps typically used in needlewheel skimmer designs. While there is debate over the merits of different skimmer designs many people consider Beckett skimmers to be the most powerful available for aquariums and they are particularly popular for larger aquariums.

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Reef aquarium

A **reef aquarium** or **reef tank** is an aquarium containing live corals and other animals associated with coral reefs. It is considered to be one of the most difficult aquarium setups to create and maintain. In recent years, advancements in our knowledge of the reef, coupled with more refined reef maintenance techniques, the reef tank has become much more accessible to the hobbyist.

From theme reefs which attempt to recreate life specific to one region of the world like the Great Barrier Reef to the more prevalent and often spectacularly colored mixed reef that blend hard and soft coral from around the world. Unlike the marine aquarium which main purpose is to house various fish, the true stars of the reef tank are the coral and other invertebrates.

Contents

- 1 Methodology
    - 1.1 The aquarium
    - 1.2 Filtration
    - 1.3 Water movement
    - 1.4 Lighting
    - 1.5 Heating & cooling

Methodology

The aquarium

The first step in building a successful reef aquarium is the tank itself. Most hobbyists prefer what are called "Reef Ready Aquariums" which are identical to regular glass or acrylic style tanks save for an internal overflow made of plastic or glass which encloses holes that have been drilled into the bottom glass to accommodate a drain or standpipe and a return line. Water pours over the overflow into and down the standpipe, through PVC piping, into a sump, which houses various filtration and heating equipment, through a return water pump and finally back via more piping through the second hole into the aquarium. An alternative method to having a tank that is already drilled is to use a hang on tank overflow with a U-tube (via a continuous siphon).

Filtration

Unlike the marine aquarium that use a combination of mechanical, chemical and biological filtration, reef aquariums primary filtration comes from the use of large amounts of live rock which come from various rubble zones around existing reefs or more recently aquacultured rock from Florida which is supplemented by powerful protein skimmers. This method first came from Germany and is aptly termed the Berlin Method.

The typical rule of thumb is to use from .75 to 2 pounds of live rock per gallon of aquarium water depending on the density of the rock – or filling the tank up 2/3 of the way to the top. The benefit of using live rock is four fold: First, live rock acts as a biological filter, adding beneficial bacteria. Secondly, it introduces an abundance of marine life to the aquarium that many fish, invertebrates and corals use for food. Thirdly, it provides a natural reef appearance with ample places to locate corals. Live rock also will help balance and stabilize PH in the aquarium.

Mechanical filtration is often avoided because sponge filters, filter floss and filter socks trap detritus and produces nitrates which stunt the growth or even kill many delicate corals. Chemical filtration is used sparingly so to avoid discoloration of the water, to remove dissolved matter (organic or otherwise) and to help stabilize the reef system.

[edit] Water movement

Corals are simple creatures with limited ability to feed, reproduce and rid themselves of waste(metabolites).

Water movement is key to the success of the reef tank with each type of coral requiring different flow rates. At present, many hobbyists advocate the 10x rule: 10 x aquarium capacity in gallons = required flow in gallons per hour. This is a general rule with many exceptions. For instance, Mushroom Coral requires little flow while many species of Acropora thrive under much more turbulent conditions in the range of 30 to 40 times more flow most likely due to their proximity to wave crests in the wild.

Of the many different types of creating this needed water flow the most popular method is by using multiple power heads which are simply small submersible water pumps. The pumps are randomly switched on and off using a wave timer. Each aimed at the flow of another power head or at the aquarium glass to create a random flow in the tank. Another method gaining popularity is the closed loop by which water is siphoned from the main tank to a pump that in turn pushes the water right back into the aquarium via multiple returns to create water turbulence.

Water flow is important to bring food to corals. No coral relies 100% on photosynthetic food. Gas exchange occurs as water flows over a coral, bringing oxygen and removing gasses. Without water flow corals die. Water flow helps reduce the risk of thermal shock. Temperature of a corals surface can be significantly higher due to infrared radiation in slower water flow. Faster water flow aids in preventing thermal shock, reducing the temperature of the corals surface.

Lighting

Another hotly debated topic is aquarium lighting. With the advent of newer and better technologies, increasing intensities and a growing spectrum, the topic of aquarium lighting can be a daunting one even for the seasoned aquarist.

Many, if not most aquarium corals contain within their tissue the symbiotic algae called zooxanthellae. It is these zooxanthellae that require light to perform photosynthesis and in turn produce simple sugars that the corals utilize for food. The challenge for the hobbyist is to provide enough light to allow photosynthesis to maintain a thriving population of zooxanthellae in a coral tissue. Though this may seem simple enough, in reality this can prove to be a very complex task.

Some corals such as the Mushroom Coral and Coral Polyps require very little light to thrive – conversely, Acropora Coral, Brain coral, Bubble Coral, Elegance Coral, Cup Coral, Torch Coral, Trumpet Coral can require substantially more intensity.

Of the various types, most popular aquarium lighting comes from metal halide, very high output or VHO, compact fluorescent and T5 high output lighting systems. Although they were once widely used, many reef tank aquarists have abandoned T12 and T8 fluorescent lamps due to their poor intensity, and mercury vapor due to its production of a limited light spectrum.

Recent advances in lighting technology have also made available a completely new technology for aquarium lighting: Light Emitting Diodes (LEDs). Although LEDs themselves are not new, the technology has only recently been adapted to produce systems with qualities that allow them to be considered viable alternatives to gas and filament based aquarium lighting systems. The newness of the technology does cause them to be relatively expensive, but there are several advantages that these systems bring over traditional lighting. Although their initial cost is much higher, they tend to be economical in the long run because they consume less power and have far longer lifespans than other systems. Also, because LED systems are comprised of hundreds of very small bulbs, their output can be controlled by a microcomputer to simulate daybreak and sunset. Some systems also have the ability to use simulate moonlight and the phases of the moon.

The choices for aquarium lighting are made complicated by variables such as color temperature, (measured in kelvins), color rendering index (CRI), photosynthetically active radiation (PAR) and lumens. Power output available to the hobbyist can range from a meager 9 W fluorescent lamp to a blinding 1000 W metal halide. Lighting systems also vary in the light output produced by each bulb type--listed in order of weakest to strongest they would be: T8/12 or normal output lamps, compact fluorescent and T5 high output, VHO, and metal halide lamps. To further complicate matters, there are several types of ballasts available: electric ballast, magnetic ballast, and pulse start ballast.

Luckily, the choice of lighting systems for a hobbyist can usually be narrowed by first determining which types of corals the hobbyist plans on keeping, since this is the primary factor in determining lighting needs.

Heating & cooling

Most hobbyists agree that a reef tank should be kept at a temperature between 78 degrees and 83 degrees Fahrenheit (26 to 28 °C). Radical temperature shifts should be avoided as these can be particularly harmful to reef invertebrates and fish. Depending on the location of the tank and the conditions therein (i.e. heat/air conditioning), you may need to install a heater and/or a chiller for the tank. Heaters are relatively inexpensive and readily available at any local fish store. Chillers, on the other hand can run well over $400 USD and are more difficult to locate. For many aquarists, installing surface fans and running home air conditioning suffice in the place of a chiller.

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Saddleback clownfish

The **Saddleback Clownfish** (*Amphiprion polymnas*) is also known as the Saddleback Anemonefish. It is a subspecies of the Clownfish.

Contents

- 1 Appearance
- 2 Habitat
- 3 Diet

Appearance

This fish is dark brown with two thick white bars. One is located just behind its eyes. The other is found in the middle of the fish's body. The Saddleback Clownfish's tail fin is bright yellow.

Habitat

The Saddleback Clownfish can be found in the Eastern Indian and Pacific oceans. It lives in anemones and rocky areas. When kept in a tank, the species requires rocky hiding places and at least 30 gallons of salt water.

Diet

This fish is an omnivore. It eats algae as well as small crustaceans. If it is kept as a pet, it should be fed three times per day.Home | Up

Taxonomic classes

Chordates

Fossil range: Latest Ediacaran - Recent

Domain: Eukaryota
Kingdom: Animalia
Subkingdom: Eumetazoa
(unranked) Bilateria
Superphylum: Deuterostomia
Phylum: **Chordata,** Bateson, 1885
Typical ClassesL See below

Chordates (phylum **Chordata**) are a group of animals that includes the vertebrates, together with several closely related invertebrates. They are united by having, at some time in their life, a notochord, a hollow dorsal nerve cord, pharyngeal slits, an endostyle, and a muscular tail extending past the anus. Some scientists argue that the true qualifier should be pharyngeal pouches rather than slits.

The phylum Chordata is broken down into three subphyla: Urochordata, Cephalochordata, and Vertebrata. Urochordate larvae have a notochord and a nerve cord but they are lost in adulthood. Cephalochordates have a notochord and a nerve cord but no vertebrae. In all vertebrates except for Hagfish, the dorsal hollow nerve cord has been surrounded with cartilaginous or bony vertebrae and the notochord generally reduced.

The chordates and two sister phyla, the hemichordates and the echinoderms, make up the deuterostomes, a superphylum.

The extant groups of chordates are related as shown in the phylogenetic tree below. Many of the taxa listed do not match traditional classes because several of those classes are paraphyletic. Different attempts to organize the profusion of chordate clades into a small number of groups, some with and some without paraphyletic taxa, have thrown vertebrate classification is in a state of flux. Also, the relationships of some chordate groups are not very well understood.

Classes of Chordata

In the subphylum Urochordata classes Ascidiacea, Thaliacea, Larvacea are found. Includes the sea squirts and tunicate worms.

In subphylum Cephalochordata, the worm-like lancelets are found.

In the subphylum Vertebrata (all animals with vertebrae) classes Myxini (hagfish), Conodonta, Hyperoartia (lampreys), Cephalaspidomorphi, Pteraspidomorphi, Placodermi, Chondrichthyes (sharks, rays and skates), Acanthodii (spiny sharks), Actinopterygii (ray-finned fish), Sarcopterygii (lobe finned fish), Amphibia (amphibians), Sauropsida (reptiles), Synapsida, Aves (birds), and Mammalia (mammals) are found.

Taxonomy & Phylogeny

Phylum Chordata Subphylum **Urochordata** - Tunicates Subphylum **Cephalochordata** - Lancelets (unranked) **Craniata** (animals with skulls) Class **Myxini** or Hyperotreti (hagfish) Subphylum **Vertebrata** (Vertebrates - animals with backbones) Class **Conodonta** (Conodonts) Class **Cephalaspidomorphi** (Paleozoic jawless fish) (unranked) **Hyperoartia** (lampreys and kin) Class **Pteraspidomorphi** (other Paleozoic jawless fish) Infraphylum **Gnathostomata** (jawed vertebrates) Class **Placodermi** (Paleozoic armoured forms) Class **Chondrichthyes** (cartilaginous fish) (unranked) **Teleostomi** (advanced fishes and their descendants) Class **Acanthodii** (Paleozoic "spiny sharks") Superclass **Osteichthyes** (bony fishes) Class **Actinopterygii** (ray-finned fish) Class **Sarcopterygii** (lobe-finned fish) Superclass **Tetrapoda** (four-legged vertebrates) Class **Amphibia** (amphibians) Series **Amniota** (amniotic egg) Class **Synapsida** (mammal-like "reptiles") Class **Mammalia** (mammals) Class **Sauropsida** - (reptiles) Class **Aves** (birds)

Note:Lines show assumed evolutionary relationships (including extinct members of taxa)

Home | Agnatha | Gnathostomata

Agnatha

Fossil range: Early Cambrian - Recent
Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Superclass: **Agnatha**
Groups
Myxini (hagfish)
Hyperoartia

- *Petromyzontidae (lampreys)*

Pteraspidomorphi
Thelodonti
Anaspida
Cephalaspidomorphi

- *Galeaspida*
  Pituriaspida
  Osteostraci

Agnatha (Greek, "no jaws") is a paraphyletic superclass of jawless fish in the phylum Chordata, subphylum Vertebrata. There are two extant groups of jawless fish (sometimes called cyclostomes), the lampreys and the hagfish, with about 60 species between them. In addition to the absence of jaws, Agnatha are characterised by absence of paired fins; the presence of a notochord both in larvae and adults; and seven or more paired gill pouches. The branchial arches supporting the gill pouches lies close to the body surface. There is a light sensitive pineal eye (homologous to the pineal gland in mammals). There is no identifiable stomach. Fertilization is external. The Agnatha are ectothermic, with a cartilaginous skeleton, and the heart contains 2 chambers.

Although they are superficially similar, many of these similarities are probably shared primitive characteristics of ancient vertebrates, and modern classifications tend to move the hagfish into a separate group (the Myxini or Hyperotreti), with the lampreys (Hyperoartii) being more closely related to the jawed fishes.

Fossil agnathans

Although a minor element of modern marine fauna, Agnatha were prominent among the early fish in the early Paleozoic. Two types of Early Cambrian animal apparently having fins, vertebrate musculature, and gills are known from the early Cambrian Maotianshan shales of China: Haikouichthys and Myllokunmingia. They have been tentatively assigned to Agnatha by Janvier. A third possible agnathid from the same region is Haikouella. A possible agnathid that has not been formally described was reported by Simonetti from the Middle Cambrian Burgess Shale of British Columbia.

Many Ordovician, Silurian, and Devonian agnathans were armored with heavy bony plates. The first armored agnathans—the Ostracoderms, precursors to the bony fish and hence to the tetrapods (including human beings)—are known from the middle Ordovician, and by the Late Silurian the agnathans had reached the high point of their evolution. Agnathans declined in the Devonian and never recovered.

Home | Up | Hagfish | Lamprey

Hagfish

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: **Myxini**
Order: **Myxiniformes**
Family: **Myxinidae**
Genera: *Eptatretus, Myxine, Nemamyxine, Neomyxine, Notomyxine, Paramyxine, Quadratus*

A **hagfish** is a marine chordate of the class **Myxini**, also known as **Hyperotreti**. Despite their name, there is some debate about whether they are strictly fish (as there is for lampreys), since they belong to a much more primitive lineage than any other group that is commonly defined fish (*Chondrichthyes* and *Osteichthyes*).

They are long, vermiform and can exude copious quantities of a sticky slime or mucus (from which the typical species Myxine glutinosa was named). When captured and held by the tail, they escape by secreting the fibrous slime, which turns into a thick and sticky gel when combined with water, and then cleaning off by tying themselves in an overhand knot which works its way from the head to the tail of the animal, scraping off the slime as it goes. Some authorities conjecture that this singular behavior may assist them in extricating themselves from the jaws of predatory fish. However, the "sliming" also seems to act as a distractant to predators, and free-swimming hagfish are seen to "slime" when agitated and will later clear the mucus off by way of the same traveling-knot behavior.

Instead of vertically articulating jaws like Gnathostomata (vertebrates with jaws), they have a pair of horizontally moving structures with toothlike projections for pulling off food. There are typically short tentacle-like protrusions around the mouth.

Hagfish enter both living and dead fish, feeding on the insides (polychaete marine worms are also prey). They tend to be quite common in their range, sometimes becoming a nuisance to fishermen by devouring the catch before it can be pulled to the surface. Not unlike leeches, they have a sluggish metabolism and can go months between feedings.

Hagfish average about half a metre (18 inches) in length; Eptatretus carlhubbsi is the largest known, with a specimen recorded at 116 cm, while Myxine kuoi and Myxine pequenoi seem to reach no more than 18 cm. An adult hagfish can secrete enough slime to turn a large bucket of water into gel in a matter of minutes.

There has been long discussion in scientific literature about the hagfish being non-vertebrate. Given their classification as Agnatha, Hagfish are seen as an elementary vertebrate inbetween Prevertebrate and Gnathostome. Thus, their classification is as an extremely primitive Vertebrate.

- They are part of the subphylum *Vertebrata* so, taxonomically speaking, they are vertebrates.
- They do not have vertebrae so, anatomically, they're not vertebrates.

Recent molecular biology analyses tend to classify hagfish as vertebrates (see references), their molecular evolutive distance from *Vertebrata (sensu stricto)* being short.

The circulatory system of the hagfish has both closed and open blood vessels, with a heart system that is the most primitive of all vertebrates, bearing some resemblance to that of some worms. This system comprises a "brachial heart", which functions as the main pump, and three types of accessory hearts: the "portal" heart(s) which carry blood from intestines to liver; the "cardinal" heart(s) which move blood from the head to the body, and the "caudal" heart(s) which pump blood from the trunk and kidneys to the body. None of these hearts are innervated, so their function is probably modulated, if at all, by hormones.

Individual hagfish are hermaphroditic, with both ovaries and testes, but the female gonads remain non-functional until the individual has reached a particular stage in the hagfish lifecycle. Hagfish do not have a larval stage, in contrast to lampreys, which have a long larval phase.

Hagfish are eaten in Japan and South Korea, and their skin is made into "eel leather" (used for so-called "eelskin" products) in Korea.

In recent years hagfish have become of special interest for genetic analysis investigating the relationships among chordates. It has also recently been discovered that the mucus excreted by the hagfish is unique in that it includes strong, threadlike fibres similar to spider silk. Research continues into potential uses for this or a similar synthetic gel or of the included fibres. Some possibilities include new biodegradable polymers, space-filling gels, and as a means of stopping blood flow in accident victims and surgery patients.

Species

About 64 species are known, in 5 genera. A number of the species have only been recently discovered, living at depths of several hundred metres. Some of the species are listed here:

- Genus Eptatretus:
  - Inshore hagfish, Eptatretus burgeri (Girard, 1855)
  - New Zealand hagfish, Eptatretus cirrhatus (Forster, 1801)
  - Black hagfish, Eptatretus deani (Evermann & Goldsborough, 1907)
  - Guadalupe hagfish, Eptatretus fritzi Wisner & McMillan, 1990
  - Sixgill hagfish, Eptatretus hexatrema (Müller, 1836)
  - Shorthead hagfish, Eptatretus mcconnaugheyi Wisner & McMillan, 1990
  - Eptatretus mendozai Hensley, 1985
  - Eightgill hagfish, Eptatretus octatrema (Barnard, 1923)
  - Fourteen-gill hagfish, Eptatretus polytrema (Girard, 1855)
  - Fivegill hagfish, Eptatretus profundus (Barnard, 1923)
  - Cortez hagfish, Eptatretus sinus Wisner & McMillan, 1990
  - Gulf hagfish, Eptatretus springeri (Bigelow & Schroeder, 1952)
  - Pacific hagfish, Eptatretus stoutii (Lockington, 1878)
- Genus Myxine:
  - Patagonian hagfish Myxine affinis Günther, 1870
  - Myxine australis Jenyns, 1842
  - Cape hagfish, Myxine capensis
  - Whiteface hagfish, Myxine circifrons Garman, 1899
  - Myxine debueni Wisner & McMillan, 1995
  - Myxine dorsum Wisner & McMillan, 1995
  - Myxine fernholmi Wisner & McMillan, 1995
  - Myxine formosana Mok & Kuo, 2001
  - Myxine garmani Jordan & Snyder, 1901
  - Hagfish (or Atlantic hagfish), Myxine glutinosa
  - Myxine hubbsi Wisner & McMillan, 1995
  - Myxine hubbsoides Wisner & McMillan, 1995
  - White-headed hagfish, Myxine ios
  - Myxine jespersenae Møller, Feld, Poulsen, Thomsen & Thormar, 2005
  - Myxine knappi Wisner & McMillan, 1995
  - Myxine kuoi Mok, 2002
  - Myxine limosa Girard, 1859
  - Myxine mccoskeri Wisner & McMillan, 1995

  - Myxine mcmillanae Hensley, 1991
  - Myxine paucidens Regan, 1913
  - Myxine pequenoi Wisner & McMillan, 1995
  - Myxine robinsorum Wisner & McMillan, 1995
  - Myxine sotoi Mincarone, 2001
- Genus Nemamyxine:
  - Nemamyxine elongata Richardson, 1958
  - Nemamyxine kreffti McMillan and Wisner, 1982
- Genus Neomyxine:
  - *Neomyxine biniplicata* (Richardson and Jowett, 1951)
- Genus Notomyxine:
  - *Notomyxine tridentiger* (Garman, 1899)
- Genus Paramyxine:
  - Paramyxine atami Dean, 1904
  - Paramyxine cheni Shen and Tao, 1975
  - Paramyxine fernholmi Kuo, Huang and Mok, 1994
  - Paramyxine sheni Kuo, Huang and Mok, 1994
  - Paramyxine wisneri Kuo, Huang and Mok, 1994
- Genus Quadratus:
  - Quadratus ancon Mok, Saavedra-Diaz and Acero P., 2001
  - Quadratus nelsoni (Kuo, Huang and Mok, 1994)
  - Quadratus taiwanae (Shen and Tao, 1975)
  - Quadratus yangi

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Lamprey

Kingdom: Animalia
Phylum: Chordata
Class: Cephalaspidomorphi
(unranked) Hyperoartia
Order: **Petromyzontiformes**
Family: **Petromyzontidae**
Subfamilies: *Geotriinae, Mordaciinae, Petromyzontinae*

A **lamprey** (sometimes also called **lamprey eel**) is a jawless fish with a toothed, funnel-like sucking mouth, with which most species bore into the flesh of other fish to suck their blood. In zoology, lampreys are often not considered to be true fish because of their vastly different morphology and physiology.

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- 5 Trivia
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Physical description

Lampreys live mostly in coastal and fresh waters, although at least one species, *Geotria australis*, probably travels significant distances in the open ocean, as is evidenced by the lack of reproductive isolation between Australian and New Zealand populations, and the capture of a specimen in the Southern Ocean between Australia and Antarctica. They are found in most temperate regions except Africa. Their larvae have a low tolerance for high water temperatures, which is probably the reason that they are not found in the tropics. Outwardly resembling eels in that they have no scales, an adult lamprey can range anywhere from 13 to 100 centimetres (5 to 40 inches) long. Lampreys have one or two dorsal fins, large eyes, one nostril on the top of their head, and seven gills on each side. The unique morphological characteristics of lampreys, such as their cartilaginous skeleton, means that they are the sister taxon (see cladistics) of all living jawed vertebrates (gnathostomes) and are not classified within the Vertebrata itself. The hagfish, which superficially resembles the lamprey, is the sister taxon of the lampreys and gnathostomes (a clade termed the Craniata).

Lampreys begin life as burrowing freshwater larvae (ammocoetes). At this stage, they are toothless, have rudimentary eyes, and feed on microorganisms. This larval stage can last five to seven years and hence was originally thought to be an independent organism. After these five to seven years, they transform into adults in a metamorphosis which is at least as radical as that seen in amphibians, and which involves a radical rearrangement of internal organs, development of eyes and transformation from a mud-dwelling filter feeder into an efficient swimming predator, which typically moves into the sea to begin a predatory/parasitic life, attaching to a fish by their mouths, secreting an anticoagulant to the host, and feeding on the blood and tissues of the host. In most species this phase lasts about 18 months. Whether lampreys are predators or parasites is a blurred question.

Not all lampreys can be found in the sea. Some lampreys are landlocked and remain in fresh water, and some of these stop feeding altogether as soon as they have left the larval stage. The landlocked species are usually rather small.

To reproduce, lampreys return to fresh water (if they left it), build a nest, then spawn, that is, lay their eggs or excrete their semen, and then invariably die. In *Geotria australis*, the time between ceasing to feed at sea and spawning can be up to 18 months long.

Recent studies reported in Nature suggest that lampreys have evolved a unique type of immune system with parts that are unrelated to the antibodies found in mammals. They also have a very high tolerance to iron overload, and have evolved biochemical defenses to detoxify this metal.

Fossil lampreys

Lamprey fossils are exceedingly rare; cartilage does not fossilize as readily as bone. Until 2006, the oldest known fossil lampreys were from Early Carboniferous limestones[1], laid down in marine sediments in North America: Mayomyzon pieckoensis and Hardistiella montanensis. In the 22 June 2006 issue of Nature, Mee-mann Chang and colleagues reported on a fossil lamprey from the same Early Cretaceous lagerstätten that have yielded feathered dinosaurs, in the Yixian Formation of Inner Mongolia. The new species, morphologically similar to Carboniferous and modern forms, was given the name Mesomyzon mengae ("Middle lamprey"). The exceedingly well-preserved fossil showed a well-developed sucking oral disk, a relatively long branchial apparatus showing branchial basket, seven gill pouches, gill arches and even the impressions of gill filaments, as well as about 80 myomeres of its musculature.

A few months later, in the 27 October issue of *Nature*, an even older fossil lamprey, dated 360 Mya, was reported from Witteberg Group rocks near Grahamstown, in the Eastern Cape of South Africa. This species, dubbed Priscomyzon riniensis still strongly resembled modern lampreys despite its Devonian age.

Taxonomy

The taxonomy presented here is that given by Fisher, 1994. This work classifies lampreys as the sole living members of the class Cephalaspidomorphi.[2] The lampreys entail the single order **Petromyzontiformes** and family **Petromyzontidae**.[3]

Within this family, there are 40 recorded species in nine genera and three subfamilies:

- Subfamily Geotriinae
  - Genus *Geotria*
    - *Geotria australis* (Gray,1851)
- Subfamily Mordaciinae
  - Genus *Mordacia*
    - Mordacia lapicida (Gray, 1851)
      Mordacia mordax (Richardson, 1846)
      Mordacia praecox (Potter, 1968)
- Subfamily Petromyzontinae
  - Genus *Caspiomyzon*
    - *Caspiomyzon wagneri* (Kessler, 1870)
  - Genus *Eudontomyzon*
    - Eudontomyzon danfordi (Regan, 1911)
      Eudontomyzon hellenicus (Vladykov, Renaud, Kott and Economidis, 1982)
      Eudontomyzon mariae (Berg, 1931)
      Eudontomyzon morii (Berg, 1931)
      Eudontomyzon stankokaramani (Karaman, 1974)
      Eudontomyzon vladykovi (Oliva and Zanandrea, 1959)
  - Genus *Ichthyomyzon*
    - Ichthyomyzon bdellium (Jordan, 1885) - Ohio lamprey
      Ichthyomyzon castaneus Girard, 1858 - chestnut lamprey
      Ichthyomyzon fossor (Reighard and Cummins, 1916) - northern brook lamprey
      Ichthyomyzon gagei (Hubbs and Trautman, 1937) - southern brook lamprey
      Ichthyomyzon greeleyi (Hubbs and Trautman, 1937) - mountain brook lamprey
      Ichthyomyzon unicuspis (Hubbs and Trautman, 1937) - silver lamprey
  - Genus *Lampetra*
    - Lampetra aepyptera (Abbott, 1860) - least brook

        lamprey
        Lampetra alaskensis (Vladykov and Kott, 1978)
        Lampetra appendix (DeKay, 1842) - American brook lamprey
        Lampetra ayresii (Günther, 1870)
        Lampetra fluviatilis (Linnaeus, 1758)
        Lampetra hubbsi (Vladykov and Kott, 1976) - Kern brook lamprey
        Lampetra lamottei (Lesueur, 1827)
        Lampetra lanceolata (Kux and Steiner, 1972)
        Lampetra lethophaga (Hubbs, 1971) - Pit-Klamath brook lamprey
        Lampetra macrostoma (Beamish, 1982) - Vancouver lamprey
        Lampetra minima (Bond and Kan, 1973) - Miller Lake lamprey
        Lampetra planeri (Bloch, 1784)
        Lampetra richardsoni (Vladykov and Follett, 1965) - western brook lamprey
        Lampetra similis (Vladykov and Kott, 1979) - Klamath lamprey
        Lampetra tridentata (Richardson, 1836) - Pacific lamprey
    - Genus *Lethenteron*
        - Lethenteron camtschaticum (Tilesius, 1811)
          Lethenteron japonicum (Martens, 1868)
          Lethenteron kessleri (Anikin, 1905)
          Lethenteron matsubarai (Vladykov and Kott, 1978)
          Lethenteron reissneri (Dybowski, 1869)
          Lethenteron zanandreai (Vladykov, 1955)
    - Genus *Petromyzon*
        - *Petromyzon marinus* (Linnaeus, 1758) - sea lamprey
    - Genus *Tetrapleurodon*
        - Tetrapleurodon geminis (Alvarez, 1964)
          Tetrapleurodon spadiceus (Bean, 1887)

Relation to humans

Lampreys have long been used as food for humans. During the Middle Ages, they were widely eaten by the upper classes throughout Europe, especially during fasting periods, since their taste is much meatier than that of most true fish. King Henry I of England is said to have died from eating "a surfeit of lampreys"

Especially in Southwestern Europe (Portugal, Spain, France) they are still a highly prized delicacy. Overfishing has reduced their number in those parts. Lampreys are also consumed in South Korea.

On the other hand, lampreys have become a major plague in the North American Great Lakes after artificial canals allowed their entry during the early 20th century. They are considered an invasive species, have no natural enemies in the lakes and prey on many species of commercial value, such as lake trout. Since the majority of North American consumers, unlike Europeans, refuse to accept lampreys as food fish, the Great Lakes fishery has been very adversely affected by their invasion. They are now fought mostly in the streams that feed the lakes, with special barriers and poisons called lampricides, which are harmless to most other aquatic species. However those programs are complicated and expensive, and they do not eradicate the lampreys from the lakes but merely keep them in check. New programs are being developed including the use of sterilization of male lamprey by trapping of prespawn adults. Research is currently under way on the use of pheromones and how they may be used to disrupt the life cycle (Sorensen, et al., 2005). Control of sea lampreys in the Great Lakes is conducted by the U.S. Fish and Wildlife Service and the Canadian Department of Fisheries and Oceans. The work is coordinated by the Great Lakes Fishery Commission.

Trivia

Vedius Pollio

Vedius Pollio was punished by Augustus for attempting to feed a clumsy slave to the lampreys in his fishpond.

> …one of his slaves had broken a crystal cup. Vedius ordered him to be seized and to be put to death in an unusual way. He ordered him to be thrown to the huge lampreys which he had in his fish pond. Who would not think he did this for display? Yet it was out of cruelty. The boy slipped from the captor's hands and fled to Caesar's feet asking nothing else other than a different way to die—he did not want to be eaten. Caesar was moved by the novelty of the cruelty and ordered him to be released, all the crystal cups to be broken before his eyes, and the fish pond to be filled in… – Seneca, *On Anger*, III, 40

Philip Larkin

Christopher Warner, a character in Philip Larkin's early novel Jill is said to have attended a fictional minor public school called Lamprey College.

King Henry I

Henry I of England was said to have died from eating too many lampreys, of which he was fond of eating

Notes

1. ^ From the Mississippian Mazon Creek lagerstätte and the Bear Gulch Limestone sequence.
2. ^ **Cephalaspidomorpha** is sometimes given as a subclass of the Cephalaspidomorphi.
3. ^ **Petromyzoniformes** and **Petromyzonidae** are sometimes used as alternative spellings for Petromyzontiformes and Petromyzontidae respectively.

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Gnathostomata

Fossil range: Late Ordovician - Recent

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Infraphylum: **Gnathostomata**
Classes: *Placodermi, Chondrichthyes, Acanthodii, Actinopterygii, Sarcopterygii*

Gnathostomata is the group of vertebrates with jaws.

The group is traditionally a superclass, including the familiar classes of fish, birds, and so forth, and a sister group of the jawless vertebrates Agnatha. However, recent genetic studies are causing a reassessment of Gnathostomata as a grouping.

It is assumed the jaws evolved from anterior gill support arches that had acquired a new role, being modified to pump water over the gills by opening and closing the mouth more effectively. The mouth could then grow bigger and wider, making it possible to capture small prey. This close and open mechanism would with time become stronger and tougher, being transformed into real jaws. Modified dermal bones on the surface of the skin would migrate into the mouth and become primtive teeth. Placoderms used sharp bony plates as teeth instead.

Other distinguishing characteristics of living gnathostomates are the myelin sheathes of neurons, and an adaptive immune system.

Taxonomy & Phylogeny

Subphylum Vertebrata (unranked) Gnathostomatomorpha Infraphylum Gnathostomata Class Placodermi - extinct (armored gnathostomes) Microphylum Eugnathostomata (true jawed vertebrates) Class Chondrichthyes (cartilagenous fish) (unranked) Teleostomi (Acanthodii & Osteichthyes) Class Acanthodii - extinct ("spiny sharks") Superclass Osteichthyes (bony fish) Class Actinopterygii (ray-finned fish) Class Sarcopterygii (lobe-finned fish) Superclass Tetrapoda Class Amphibia (amphibians) (unranked) Amniota (amniotic egg) Class Sauropsida (reptiles or sauropsids) Class Aves (birds) Class Synapsida Class Mammalia (mammals)

Note lines show evolutionary relationships.

Home | Up | Cartilaginous fishes | Bony fish

Cartilaginous fishes

Fossil range: Early Silurian - Recent

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Infraphylum: Gnathostomata
Class: **Chondrichthyes,** Huxley, 1880
Subclasses and Orders: See text.

The **Chondrichthyes** or **cartilaginous fishes** are jawed fish with paired fins, paired nostrils, scales, two-chambered hearts, and skeletons made of cartilage rather than bone. They are divided into two subclasses: Elasmobranchii (sharks, rays and skates) and Holocephali (chimaera, sometimes called ghost sharks).

Characteristics

Chondrichthyes have internal fertilization and a reproduction strategy reminiscent of that seen in amniotes. They also have a relative brain development of its major divisions, reminiscent of those found in birds and mammals. Their brain weight relative to body size comes close to that of mammals, and is about ten times that of bony fishes. There are exceptions: the mormyrid bony fishes have a relative brain size comparable to humans, while the primitive megamouth shark has a brain of only 0.002 percent of its body weight. One of the explanations for their relatively large brains is that the density of nerve cells is much lower than in the brains of bony fishes, making the brain less energy demanding and allowing it to be bigger.

Their digestive systems have spiral valves, and with the exception of Holocephali, they also have a cloaca.

As they do not have bone marrow, red blood cells are produced in the spleen and special tissue around the gonads. They are also produced in an organ called Leydig's Organ which is only found in cartilaginous fishes, although some have lost it. Another unique organ is the epigonal organ which probably has a role in the immune system. The subclass Holocephali, which is a very specialized group, lacks both of these organs.

Originally the pectoral and pelvic girdles, which do not contain any dermal elements, did not connect. In later forms, each pair of fins became ventrally connected in the middle when scapulocoracoid and pubioischiadic bars evolved. In rays, the pectoral fins have connected to the head and are very flexible.

A spiracle is found behind each eye on most species, although Holocephali and some pelagic sharks have lost it.

Their tough skin is covered with dermal teeth (again with Holocephali as an exception as the teeth are lost in adults, only kept on the clasping organ seen on the front of the male's head), also called placoid scales or dermal denticles, making it feel like sandpaper. It is assumed that their oral teeth evolved from dermal denticles which migrated into the mouth. But it could be the other way around as the teleost bony fish Denticeps clupeoides has most of its head covered by dermal teeth (as do probably Atherion elymus, another bony fish). This is most probably a secondary evolved characteristic which means there is not necessarily a connection between the teeth and the original dermal scales. The old placoderms did not have teeth at all, but had sharp bony plates in their mouth. So what came first, the oral teeth or the dermal teeth, is not known for sure. Neither is it sure how many times it has happened if it turns out to be the case. It has even been suggested that the original bony plates of all the vertebrates are gone and that the present scales are just modified teeth, even if both teeth and the body armour have a common origin a long time ago. But for the moment there is no evidence of this.

Taxonomy

- Subclass Elasmobranchii (sharks, rays and skates)
    - Superorder Batoidea (rays and skates), containing the orders:
        1. Rajiformes (common rays and skates)
           Pristiformes (Sawfishes)
           Torpediniformes (electric rays)
    - Superorder Selachimorpha (sharks), containing the orders:
        1. Hexanchiformes Two families are found within this order. Species of this order are distinguished from other sharks by having additional gill slits (either six or seven). Examples from this group include the cow sharks, frilled shark and even a shark that looks on first inspection to be a marine snake.
           Squaliformes Three families and more than 80 species are found within this order. These sharks have two dorsal fins, often with spines, and no anal fin. They have teeth designed for cutting in both the upper and lower jaws. Examples from this group include the bramble sharks, dogfish and roughsharks.
           Pristiophoriformes One family is found within this order. These are the sawsharks, with an elongate, toothed snout that they use for slashing the fishes that they then eat.
           Squatiniformes One family is found within this order. These are flattened sharks that can be distinguished from the similar appearing skates and rays by the fact that they have the gill slits along the side of the head like all other sharks. They have a caudal fin (tail) with the lower lobe being much longer in length than the upper, and are commonly referred to as angel sharks.
           Heterodontiformes One family is found within this order. They are commonly referred to as the bullhead, or horn sharks. They have a variety of teeth allowing them to grasp and then crush shellfishes.
           Orectolobiformes Seven families are found within this order. They are commonly referred to as the carpet sharks, including zebra sharks, nurse sharks, wobbegongs and the largest of all fishes, the whale

  sharks. They are distinguished by having barbels at the edge of the nostrils. Most, but not all are nocturnal.

  Carcharhiniformes Eight families are found within this order. It is the largest order, containing almost 200 species. They are commonly referred to as the groundsharks, and some of the species include the blue, tiger, bull, reef and oceanic whitetip sharks (collectively called the requiem sharks) along with the houndsharks, catsharks and hammerhead sharks. They are distinguished by an elongated snout and a nictitating membrane which protects the eyes during an attack.

  Lamniformes Seven families are found within this order. They are commonly referred to as the mackerel sharks. They include the goblin shark, basking shark, megamouth, the thresher, mako shark and great white shark. They are distinguished by their large jaws and ovoviviparous reproduction. The Lamniformes contains the extinct Megalodon (Carcharodon megalodon), which like most extinct sharks is only known by the teeth (the only bone found in these cartilaginous fishes, and therefore are often the only fossils produced). A reproduction of the jaw was based on some of the largest teeth (up to almost 7 inches in length) and suggested a fish that could grow 120 feet in length. The jaw was realized to be inaccurate, and estimates revised downwards to around 50 feet.

- Subclass Holocephali (chimaera)

Bony fish

Fossil range: Late Silurian - Recent

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Infraphylum: Gnathostomata
Superclass: **Osteichthyes**
Class: *Actinopterygii*, *Sarcopterygii*

Osteichthyes are a taxonomic superclass of fish, also called *bony fish* that includes the ray-finned fish (Actinopterygii) and lobe finned fish (Sarcopterygii).

The **Osteichthyes** are paraphyletic with land vertebrates, in some classification schemes the tetrapods *et al* are considered to be members of the Osteichthyes for this reason.

Most bony-fish belong to the Actinopterygii, there are only eight living species of lobe finned fish (Sarcopterygii) including the lungfish and coelacanths. (Some species of lobe-finned fish have jointed bones.)

They are traditionally treated as a class of vertebrates, with subclasses Actinopterygii and Sarcopterygii, but some newer schemes divide them into several separate classes.

The vast majority of fish are osteichthyes. Osteichthyes are the most various group of vertebrates, consisting of over 29,000 species, making them the largest class of vertebrates in existence today.

Contents

- 1 Characteristics
  - 1.1 Replacement bone
- 2 Examples

Characteristics

Osteichthians are characterized by a relatively stable pattern of cranial bones, rooted teeth, medial insertion of mandibular muscle in lower jaw. The head and pectoral girdles are covered with large dermal bones. The eyeball is supported by a sclerotic ring of four small bones, but this characteristic has been lost or modified in many modern species. The labyrinth in the inner ear contains large otoliths. The braincase, or neurocranium, is frequently divided into anterior and posterior sections divided by fissure. Osteichthyans have a lung or swim bladder. They do not have fin spines, but instead support the fin with lepidotrichia (bone fin rays). They also have an operculum, which helps them breathe without having to swim.

Replacement bone

One of the best-known innovations of the osteichthians is endochondral bone or "replacement" bone, i.e. bone ossified internally, by replacement of cartilage, as well as perichondrally, as "spongy bone." In the more general vertebrates there are various types of calcified tissue: dentine, enamel (or "enameloids") and bone, plus variants characterized by their ontogeny, chemistry, form and location. But endochondral bone is unique because it begins life as cartilage.

In more basal vertebrates, cartilaginous structures can become superficially calcified. However, in osteichthians, the circulatory system invades the cartilaginous matrix. This permits the local osteoblasts (bone-forming cells) to continue bone formation within the cartilage and also recruits additional, circulating osteoblasts. Other cells gradually eat away at the surrounding cartilage. The net result is that the cartilage is replaced from within by a somewhat irregular vascularized network of bone. Structurally, the effect is to create a relatively lightweight, flexible, "spongy" bone interior, surrounded by an outline of dense, lamellar periostial bone. Since this bone now surrounds other bone, rather than cartilage, it is referred to as periostial rather than perichondral. This is the unique endochondral bone from which the osteichthians derived their name, as well as many structural advantages. However useful endochondral bone may be, it is also much heavier and less flexible than cartilage. Thus, many modern osteichian groups, including the extremely successful teleosts, have evolved away from extensive use of endochondral bone.

The dissection of a bony, or any other fish can prove quite useful to study internal organs.

Examples

The ocean sunfish is the most massive bony fish in the world (but not the longest one; that honor goes to the oarfish). Specimens of ocean sunfish have been observed up to 3.33 m (11 ft) in length and weighing up to 2,300 kg (5,070 lb). Other very large bony fish include the Atlantic blue marlin, some specimens of which have been recorded as in excess of 820 kilograms (1,807.4 lb.), the black marlin, and some sturgeon species.

Home | Up | Ray-finned fish | Lobe-finned fish

Ray-finned fish

Fossil range: Latest Silurian–Recent

Kingdom: Animalia
Phylum: Chordata
Infraphylum: Gnathostomata
Superclass: Osteichthyes
Class: **Actinopterygii,** Klein, 1885
Subclasses: *Chondrostei, Neopterygii*
See text for orders.

The **Actinopterygii** are the **ray-finned** **fish**. They are the dominant group of vertebrates, with over 27,000 species ubiquitous throughout fresh water and marine environments.

Classification

Traditionally three grades of Actinopterygii have been recognized: the **Chondrostei**, **Holostei**, and **Teleostei**. The second is paraphyletic and tends to be abandoned, however, while the first is now restricted to those forms closer to extant Chondrostei than to the other groups. Nearly all fish alive today are teleosts.

A listing of the different groups is given below, down to the level of orders, arranged in what is believed to represent the evolutionary sequence down to the level of superorder. The listing follows FishBase[1] with notes when this differs from Nelson[2] and ITIS.[3]

- **Subclass Chondrostei**
  - Order Polypteriformes, *including the bichirs and reedfishes*
  - Order Acipenseriformes, *including the sturgeons and paddlefishes*
- **Subclass Neopterygii**
  - **Infraclass Holostei**
    - Order Lepisosteiformes, *the gars*
    - Order Amiiformes, *the bowfins*
  - **Infraclass Teleostei**
    - **Superorder Osteoglossomorpha**
      - Order Osteoglossiformes, *the bony-tongued fishes*
      - Order Hiodontiformes, *including the mooneye and goldeye*
    - **Superorder Elopomorpha**
      - Order Elopiformes, including the ladyfishes and tarpon
      - Order Albuliformes, the bonefishes
      - Order Notacanthiformes, including the halosaurs and spiny eels
      - Order Anguilliformes, the true eels and gulpers
      - Order Saccopharyngiformes, including the gulper eel
    - **Superorder Clupeomorpha**
      - Order Clupeiformes, *including herrings and anchovies*
    - **Superorder Ostariophysi**
      - Order Gonorynchiformes, including the milkfishes
      - Order Cypriniformes, including barbs, carp, danios, goldfishes, loaches, minnows,

    rasboras
    Order Characiformes, including characins, pencilfishes, hatchetfishes, piranhas, tetras.
    Order Gymnotiformes, including electric eels and knifefishes
    Order Siluriformes, the catfishes
- **Superorder Protacanthopterygii**
    - Order Salmoniformes, including salmon and trout
      Order Esociformes the pike
      Order Osmeriformes, including the smelts and galaxiids
- **Superorder Stenopterygii**
    - Order Ateleopodiformes, the jellynose fish
      Order Stomiiformes, including the bristlemouths and marine hatchetfishes
- **Superorder Cyclosquamata**
    - Order Aulopiformes, including the Bombay duck and lancetfishes
- **Superorder Scopelomorpha**
    - Order Myctophiformes, *including the lanternfishes*
- **Superorder Lampridiomorpha**
    - Order Lampriformes, including the oarfish, opah and ribbonfishes
- **Superorder Polymyxiomorpha**
    - Order Polymixiiformes, *the beardfishes*
- **Superorder Paracanthopterygii**
    - Order Percopsiformes, including the cavefishes and trout-perches
      Order Batrachoidiformes, the toadfishes
      Order Lophiiformes, including the anglerfishes
      Order Gadiformes, including cods
      Order Ophidiiformes, including the pearlfishes
- **Superorder Acanthopterygii**
    - Order Mugiliformes, the mullets
      Order Atheriniformes, including silversides and rainbowfishes
      Order Beloniformes, including the flyingfishes
      Order Cetomimiformes, the whalefishes
      Order Cyprinodontiformes, including livebearers, killifishes

Order Stephanoberyciformes, including the ridgeheads
Order Beryciformes, including the fangtooths and pineconefishes
Order Zeiformes, including the dories
Order Gobiesociformes, the clingfishes[4]
Order Gasterosteiformes including sticklebacks, pipefishes, seahorses
Order Syngnathiformes, including the seahorses and pipefishes [5]
Order Synbranchiformes, including the swamp eels
Order Tetraodontiformes, including the filefishes and pufferfish
Order Pleuronectiformes, the flatfishes
Order Scorpaeniformes, including scorpionfishes and the weaver fish
Order Perciformes 40% of all fish including anabantids, bass, cichlids, gobies, gouramis, mackerel, perches, scats, whiting, wrasses

Notes

1. ˆ R. Froese and D. Pauly (editors) (February 2006). FishBase.
2. ˆ *Joseph S. Nelson. Fishes of the World. John Wiley & Sons. ISBN 0-471-54713-1.*
3. ˆ Actinopterygii (TSN 161061). Integrated Taxonomic Information System. Accessed on 3 April 2006.
4. ˆ In ITIS, Gobiesociformes is placed as the suborder Gobiesocoidei of the order Perciformes.
5. ˆ In ITIS, Syngnathiformes is placed as the suborder Syngnathoidei of the order Gasterosteiformes.

Home | Up | Acipenseriformes | Albuliformes | Amiiformes | Anguilliformes | Ateleopodiformes | Atheriniformes | Aulopiformes | Batrachoidiformes | Beloniformes | Beryciformes | Cetomimiformes | Characiformes | Clupeiformes | Cypriniformes | Cyprinodontiformes | Elopiformes | Esociformes | Gadiformes | Gasterosteiformes | Gobiesociformes | Gonorynchiformes | Gymnotiformes | Hiodontiformes | Lampriformes | Lepisosteiformes | Lophiiformes | Mugiliformes | Myctophiformes | Notacanthiformes | Ophidiiformes | Osmeriformes | Osteoglossiformes | Perciformes | Percopsiformes | Pleuronectiformes | Polymixiiformes | Polypteriformes | Saccopharyngiformes | Salmoniformes | Scorpaeniformes | Siluriformes | Stephanoberyciformes | Stomiiformes | Synbrachiformes | Synbranchiformes | Syngnathiformes | Tetraodontiformes | Zeiformes

Acipenseriformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Acipenseriformes**
Families: *Acipenseridae—sturgeons, Polyodontidae—paddlefishes, Chondrosteidae—extinct, Errolichthyidae—extinct*

Acipenseriformes are an order of primitive ray-finned fishes that includes the sturgeons and paddlefishes, as well as some extinct families.[1]

Acipenseriform skeletons are largely cartilage.

Systematics

Acipenseriformes

- **Family Acipenseridae**
    - Subfamily Acipenserinae
        - Genus *Acipenser*
            - *Acipenser baerii*
                - Siberian sturgeon, Acipenser baerii baerii
                  Baikal sturgeon, Acipenser baerii baicalensis
            - Shortnose sturgeon, Acipenser brevirostrum (USA)
              Yangtze sturgeon, Acipenser dabryanus
              Lake sturgeon, Acipenser fulvescens (USA)
              Russian sturgeon, Acipenser gueldenstaedtii
              Green sturgeon, Acipenser medirostris
              Sakhalin sturgeon, Acipenser mikadoi
              Japanese sturgeon, Acipenser multiscutatus
              Adriatic sturgeon, Acipenser naccarii
              Fringebarbel sturgeon, Acipenser nudiventris
            - *Acipenser oxyrinchus* (USA)
                - Gulf sturgeon, Acipenser oxyrinchus desotoi
                  Atlantic sturgeon, Acipenser oxyrinchus oxyrinchus
            - Persian sturgeon, Acipenser persicus
              Sterlet, Acipenser ruthenus
              Amur sturgeon, Acipenser schrenckii
              Chinese sturgeon, Acipenser sinensis
              Starry sturgeon, Acipenser stellatus
              European sturgeon, Acipenser sturio (also [wrongly] "Baltic sturgeon")
              White sturgeon, Acipenser transmontanus
        - Genus *Huso*
            - Beluga sturgeon, Huso huso
              Kaluga sturgeon, Huso dauricus
    - Subfamily Scaphirhynchinae
        - Genus *Scaphirhynchus*
            - Pallid sturgeon, Scaphirhynchus albus
              Shovelnose sturgeon, Scaphirhynchus platorynchus

      Alabama sturgeon, Scaphirhynchus suttkusi
    - Genus *Pseudosaphirhynchus*
      - Dwarf sturgeon, Pseudoscaphirhynchus hermanni
        Syr Darya sturgeon, Pseudoscaphirhynchus fedtschenkoi
        Amu Darya sturgeon, Pseudoscaphirhynchus kaufmanni

- **Family Polyodontidae (Paddlefish)**
  - Genus *Polyodon*
    - American paddlefish, *Polyodon spathula* (USA)
  - Genus *Psephurus*
    - Chinese paddlefish, *Psephurus gladius*

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1. ^ "Acipenseriformes". *FishBase.* Ed. Ranier Froese and Daniel Pauly. 05 2006 version. N.p.: FishBase, 2006.

- Martin Hochleithner and Joern Gessner, *The Sturgeons and Paddlefishes of the World: Biology and Aquaculture*
- Martin Hochleithner, Joern Gessner, and Sergej Podushka, *The Bibliography of Acipenseriformes*

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Albuliformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Albuliformes**
Family: **Albulidae,** Bleeker, 1859
Genera: *Albula, Pterothrissa*
See text for species.

The **bonefishes** are a family (**Albulidae**) of ray-finned fish that are popular as game fish in Florida, the Bahamas where two bonefish are on their 10 cent coin, and elsewhere. The family is small, with eight species in two genera.[1]

Presently the bonefishes are in their own order: **Albuliformes**. The spiny eels (Notacanthidae) and halosaurs (Halosauridae) were previously classified in this order[2], but are now, according to FishBase given their own order, Notacanthiformes.[3]

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  - 1.1 Albula
  - 1.2 Pterothrissus
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Description

Albula

The bonefishes' closest relatives are the tarpons and ladyfishes in the order Elopiformes. Bonefishes are unlike tarpons in that their mouth is under the snout rather than the end of it, and bonefishes lack the tarpons' protruding snout. Like tarpons and ladyfishes, bonefishes can breathe air via a modified swim-bladder and are found in brackish waters. Bonefish larvae are leptocephalic.

The body of the bonefish is silver and slender with a bluish or greenish back. On the upper half there are dark streaks with cross bands connecting to the lateral line. The body is also rounded and has a long downward aiming snout. The dorsal and caudal fins are black. Bonefish vary in adult length from 40–100 cm depending on species. The average size of a bonefish is from 3 to 5 pounds (1–2 kg) with the Florida record being 15 pounds 6 ounces (7.0 kg).

The bonefishes are brackish or saltwater fish typically living in estuaries and travelling out to sea to spawn on a lunar cycle. They feed in the shallow sand and mud flats, on animals that live on the bottom like worms, mollusks, shrimps, and crabs. They use their conical shaped snouts to root out their prey and can often be seen with their tail out of the water. Bonefishes possess crushing teeth in the palate.

Pterothrissus

This genus is like *Albula* except they are found in deeper waters.

Species

FishBase lists eight species in two genera:[1]

- Genus *Albula*
    - Albula argentea (Schneider, 1801).
    - Longjaw bonefish, Albula forsteri Valenciennes, 1847.
    - Roundjaw bonefish, Albula glossodonta (Forsskål, 1775).
    - Threadfin bonefish, Albula nemoptera (Fowler, 1911).
    - Sharpjaw bonefish, Albula neoguinaica Valenciennes, 1847.
    - Bonefish, Albula vulpes (Linnaeus, 1758).
- Genus *Pterothrissus*
    - Longfin bonefish, Pterothrissus belloci Cadenat, 1937.
    - Japanese gissu, Pterothrissus gissu Hilgendorf, 1877.

References

1. ^ *a* *b* "Albulidae". *FishBase*. Ed. Ranier Froese and Daniel Pauly. 05 2006 version. N.p.: FishBase, 2006.
2. ^ Mikko's Phylogeny Archive for Albuliformes.
3. ^ "Notacanthiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. 05 2006 version. N.p.: FishBase, 2006.

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Amiiformes

Bowfin
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Amiiformes,** Hay, 1929
Family: **Amiidae,** Bonaparte, 1838
Genus: ***Amia***
Species: ***A. calva***
Binomial name: ***Amia calva,*** Linnaeus, 1766

The **bowfins** are an order (**Amiiformes**) of primitive ray-finned fish. Only one species, the bowfin *Amia calva*, family **Amiidae**, exists today, although additional species in six families are known from Jurassic, Cretaceous, and Eocene fossils. These included the huge Leedsicthys, the biggest fish that ever existed. The bowfin and the gar are two of the freshwater fishes still extant that existed, almost unchanged from their current form, while the great dinosaurs roamed the earth.

The most distinctive characteristic of the bowfin is its very long dorsal fin consisting of 45 to 50 rays, and running from mid-back to the base of the tail. The caudal fin is a single lobe. They can grow up to 1 meter in length, and weigh 7 kg. Not a very good food fish compared to many other freshwater species, they are often considered "trash" fish by sportsmen who catch them, and are scorned for their voracious appetite in eating both gamefish and panfish of more desirable species. However, they battle powerfully when hooked, offering a tremendous fight to the angler. Bowfin, when caught, should be handled carefully. They are very pugnacious, and consider themselves a match for anything - including a human being. Once in the boat, they will make every attempt they can at biting the fisherman - and they have a mouthful of very sharp teeth.

Bowfins are found throughout eastern North America, typically in slow-moving backwaters. When the oxygen level is low (as often happens in still waters), the bowfin can rise to the surface and gulp air into its swim bladder, which is lined with blood vessels and can serve as a sort of lung.

The list of local and alternate names the bowfin is known by is lengthy, but common ones include "dogfish", "grindle" and "lawyer".

They are nocturnal feeders, eating a variety of invertebrates (insects, crayfish) and vertebrates (frogs, fishes of all types).

Males are said to turn "bluish" when breeding [1]. The male bowfin exhibits extensive parental care. He clears an area in the mud for the female to lay eggs in, and then he fertilizes them. He hovers nearby and aggressively protects the eggs and the fry after they emerge.[1]

References

1. ^ Berra, Tim M. (2001). *Freshwater Fish Distribution*. San Diego: Academic Press. ISBN 0120931567

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Anguilliformes

True eels

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Anguilliformes**
Suborders: See text for suborders and families.

True eels (**Anguilliformes**) are an order of fish, which consists of 4 suborders, 19 families, 110 genera and 400 species. Most eels are predators.

The flat and transparent larva of the eel is called a leptocephalus. A young eel is called an **elver**.

Most eels prefer to dwell in shallow waters or hide at the bottom layer of the ocean, sometimes in holes. Only the Anguillidae family comes to fresh water to dwell there (not to breed). Some eels dwell in deep water (in case of family Synaphobranchidae, this comes to a depth of 4,000 m), or are active swimmers (the family Nemichthyidae - to the depth of 500 m).

Contents

- 1 Biology
  - 1.1 Description
  - 1.2 Life cycle
- 2 Classification
- 3 Suborders and families
- 4 Use by humans
- 5 Other Information

Biology

Description

Eels lack pelvic fins and the associated skeletal structures. The pectoral fins (in those species that have them) are midlateral in position and lack the posttemporal bone, which connects the shoulder girdle to the skull. The caudal and anal fins are long, usually connecting with the tail (caudal) fin. The caudal fin lacks rays or may be absent. The body is very elongated.

The number of rays of the gill webbing ranges from 6 to 51, though sometimes they are absent altogether. The scales are cycloid or absent.

Depending on their species, eels can reach from 10 cm to 3 m, and weigh up to 65 kg.

Life cycle

The life cycle of the eel was a mystery for a very long time, because larval eels look very different from adult eels, and were thought to be a separate species.

Classification

This classification follows FishBase in dividing the eels into fifteen families. Additional families that are included in other classifications (notably ITIS and Systema Naturae 2000) are noted below the family with which they are synomized in the FishBase system.

Suborders and families

Suborder Anguilloidei

- Anguillidae (freshwater eels)
  Chlopsidae (false morays)
  Heterenchelyidae
  Moringuidae (spaghetti eels)
  Muraenidae (moray eels)
  Myrocongridae

Suborder Congroidei

- Colocongridae
- Congridae (congers)
    - Including Macrocephenchelyidae
- Derichthyidae (longneck eels)
    - Including Nessorhamphidae
- Muraenesocidae (conger pikes)
  Nettastomatidae (witch eels)
  Ophichthidae (snake eels)

Suborder Nemichthyoidei

- Nemichthyidae (snipe eels)
  Serrivomeridae (sawtooth eels)

Suborder Synaphobranchoidei

- Synaphobranchidae (cutthroat eels)
    - Including Dysommidae, Nettodaridae, and Simenchelyidae

In some classifications the family Cyematidae of bobtail snipe eels is included in the Anguilliformes, but in the FishBase system that family is included in the order Saccopharyngiformes.

The so-called "Electric Eel" of South America is not a true eel, but is more closely related to the Carp.

Use by humans

Freshwater eels (*unagi*) and marine eels (Conger eel, anago) are commonly used in Japanese cuisine. Unadon is a very popular but rather expensive food. Eels are used in Cantonese and Shanghai cuisine too. The European eel and other freshwater eels are eaten in Europe, the United States, and other places around the world. A traditional East London food is jellied eels. The Basque delicacy angulas consists of deep-fried elvers.

Other Information

In recent years, some cryptozoologists have theorised that the Loch Ness Monster might be a giant eel (as was the case in Steve Alten's novel *The Loch*, where the monster was a giant Sargasso anguilla eel).

There is an urban legend that wallets made out of electric eels will demagnetize your credit cards. This was proven to be untrue in an episode of the Mythbusters TV show. Actually, as pointed out in the Straight Dope, eel-skin wallets are made from hagfish which are unrelated to electric eels. Furthermore, it seems that magnetic clasps, not eel leather, are to blame for demagnetization.

Eel blood is toxic. The toxic protein it contains is destroyed by cooking. The toxin derived from eel blood serum was used by Charles Robert Richet in his Nobel winning research which discovered anaphylaxis (by injecting it into dogs and observing the effect).

On January 31, 1930, the Danish research ship; "The Dana", captured, (south of Africa's Cape of Good Hope), what they thought at the time was a six-feet long eel larva. This could have meant there were very long eels in the sea, since the typical eel larva is three inches long, while the adults can grow from about 4 feet to 16 feet long. In 1970, Dr. David G. Smith from the University of Miami, identified the larva found as that of the spiny eel, an eel-like fish whose larvae length is equal to its adult length, while the larvae length of the true eel is much shorter than its adult length.

In Micronesia, eels are believed to hold the souls of one's departed relatives. As such, killing eels is a grave offence and was once punishable by death.

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Ateleopodiformes

Jellynose fishes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Ateleopodiformes**
Family: **Ateleopodidae**
Genera: *Ateleopus, Guentherus, Ijimaia, Parateleopus*
See text for species.

The **jellynose fishes** are a small order (**Ateleopodiformes**) of ray-finned fish, consisting of a single family (**Ateleopodidae**) with about a dozen species in four genera.

Jellynoses are deep-water marine fish. Their skeletons are largely cartilage (thus the name), although they are true teleosts, and not at all related to Chondrichthyes. Heads are large, with a bulbous nose, and the (usually) elongated body tapers towards the tail. Their caudal fins are very small, and merged with long anal fins, and the pelvic fins are single rays, except for Guentherus. Dorsal fins tend to be prominent and placed just behind the head. The species have a range of sizes, the longest reaching 2 meters.

They are found in the Caribbean Sea, eastern Atlantic Ocean, and the Indo-Pacific area. Most of the species are poorly-known, but the highfin tadpole fish, *Guentherus altivelis*, is of potential interest for commercial fishing.

Species

- Genus *Ateleopus*
    - Ateleopus indicus Alcock, 1891.
      Ateleopus japonicus Bleeker, 1854.
      Ateleopus natalensis Regan, 1921.
      Ateleopus purpureus Tanaka, 1915.
      Ateleopus tanabensis Tanaka, 1918.
- Genus *Guentherus*
    - Highfin tadpole fish, Guentherus altivela Osório, 1917.
- Genus *Ijimaia*
    - Ijimaia antillarum Howell Rivero, 1935.
      Ijimaia dofleini Sauter, 1905.
      Ijimaia fowleri Howell Rivero, 1935.
      Loppe's tadpole fish, Ijimaia loppei Roule, 1922.
      Deep water ateleopid fish, Ijimaia plicatellus (Gilbert, 1905).
- Genus *Parateleopus*
    - *Parateleopus microstomus* Smith & Radcliffe, 1912.

References

- "Ateleopodidae". *FishBase*. Ed. Ranier Froese and Daniel Pauly. May 2006 version. N.p.: FishBase, 2006.

Atheriniformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Atheriniformes**
Families
Suborder Bedotioidei
  Betodiidae
Suborder Melanotaenioidei
  Melanotaeniidae (rainbowfishes)
  Pseudomugilidae (blue eyes)
Suborder Atherinoidei
  Atherinidae (silversides)
  Atherinopsidae (Neotropical silversides)
  Notocheiridae
  Telmatherinidae (sailfin silversides)
  Dentatherinidae
  Phallostethidae

Atheriniformes is an order of ray-finned fish that includes the silversides and several less-familiar families, including the unusual Phallostethidae.

Members of the order usually have two dorsal fins, the first with flexible spines, and an anal fin with one spine at the front. The lateral line is typically weak or absent. Atheriniform larvae share several characteristics; the gut is unusually short, there is a single row of melanophores along the back, and the fin rays do not become evident until some time after hatching.

Classification of the atheriniforms is uncertain, with the best evidence for monophyly in the larval characteristics mentioned above.

Reference

- J.S. Nelson, *Fishes of the World*

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Aulopiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Aulopiformes**
Suborders: *Alepisauroidei, Aulopoidei, Chlorophthalmoidei, Enchodontoidei, Giganturoidei, Synodontoidei*
See text for families.

Aulopiformes is an order of ray-finned fish consisting of thirteen living families of marine fish. They are grouped together on the strength of common features of pharyngobranchial structure. The common name **grinners** is sometimes used for this group.

Many of the aulopiforms are deep-sea fishes, and some species are hermaphrodites.

Families

- Suborder Alepisauroidei
  - Synodontidae (lizardfishes)
    Synodontidae: Deepsea lizardfish, *Bathysaurus ferox*
- Suborder Aulopoidei
  - Aulopodidae (aulopus)
- Suborder Chlorophthalmoidei
  - Bathysauroididae
    Chlorophthalmidae (greeneyes)
    Ipnopidae
    Notosudidae (waryfishes)
    Scopelarchidae (pearleyes)
- Suborder Enchodontoidei
  - Apateopholidae (extinct)
    Cimolichthyidae (extinct)
    Dercetidae (extinct)
    Enchodontidae (extinct)
    Eurypholidae (extinct)
    Halecidae (extinct)
    Ichthyotringidae (extinct)
    Prionolepididae (extinct)
- Suborder Giganturoidei
  - Alepisauridae (lancetfishes)
    Anotopteridae (daggertooth)
    Evermannelidae (sabertooth fishes)
    Giganturidae (telescopefishes)
  - Giganturidae: Gigantura chuni
    Omosudidae
    Paralepididae (barracudinas)
    Pseudotrichonotidae
- Suborder Synodontoidei
  - Paraulopidae (grinners)

References

- J. S. Nelson, *Fishes of the World*

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Batrachoidiformes

Toadfishes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Batrachoidiformes**
Family: **Batrachoididae**
Genera
Subfamily Batrachoidinae
Amphichthys
Austrobatrachus
Barchatus
Batrichthys
Batrachoides
Batrachomoeus
Chatrabus
Halobatrachus
Halophryne
Opsanus
Perulibatrachus
Riekertia
Sanopus
Tharbacus
Triathalassothia
Subfamily Porichthyinae
Aphos
Porichthys
Subfamily Thalassophryninae
Daector
Thalassophryne

The **toadfishes** are a type of ray-finned fish normally found on the sand and mud bottoms of coastal waters worldwide, notable for somewhat broad heads and drab coloration reminiscent of terrestrial toads, as well as for the ability of some species to "sing" using their swim bladders. They are normally classified as the sole family **Batrachoididae** of the order **Batrachoidiformes**, and include about 70 species in 19 genera, among them the common oyster toadfish, *Opsanus tau*.

Toadfishes are usually scaleless, with eyes set high on large heads. Their mouths are also large, with both maxilla and premaxilla. The pelvic fins are forward of the pectoral fins, usually under the gills, and have one spine with several soft rays.

Almost all are marine, but *Daector quadrizonatus* and *Thalassophryne amazonica* are known from Colombia (Atrato River) and the Amazon River, respectively.

Toadfishes of the genus *Porichthys*, the midshipman fishes, have photophores and four lateral lines, while the Thalassophryninae are venomous, with a total of four hollow spines (two dorsal and one on each opercle) connecting to venom glands and capable of delivering a painful wound. That will mess you up.

Reference

- J.S. Nelson, Fishes of the World
-

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Beloniformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Beloniformes**
Families

- Suborder Adrianichthyoidei
    - Adrianichthyidae - ricefishes
- Suborder Belonoidei
    - Superfamily Scomberesocoidea
        - Belonidae - needlefishes
        - Scomberesocidae - sauries
    - Superfamily Exocoetoidea
        - Exocoetidae - flyingfishes
        - Hemiramphidae - halfbeaks

Beloniformes is an order of ray-finned fish most notable for the flyingfishes and medakas.

Originally, the two suborders Adrianichthyoidei and Belonoidei were part of the Cyprinidontiformes, but monophyly is indicated by various characteristics including the absence of the interhyal, resulting in the upper jaw being fixed or nonprotrusible.

Reference

- J.S. Nelson, *Fishes of the World*

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Beryciformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Beryciformes**
Suborders: *Berycoidei, Holocentroidei, Trachichthyoidei*

Beryciformes is an order of ray-finned fishes.

Classification

- Suborder Berycoidei
    - Berycidae -- alfonsinos, berycids
- Suborder Holocentroidei
    - Holocentridae -- soldierfishes, squirrelfishes
- Suborder Trachichthyoidei
    - Anomalopidae -- flashlight fishes, lanterneye fishes
      Anoplogastridae -- fangtooth fishes, fangtooths
      Diretmidae -- spinyfins
      Monocentridae -- pineconefishes
      Trachichthyidae -- redfishes, roughies, slime heads

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Cetomimiformes

Whalefishes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Cetomimiformes**
Families: *Cetomimidae, Rondeletiidae, Barbourisiidae, Megalomycteridae, Mirapinnidae*

The **Cetomimiformes** or **whalefishes** are an order of small, deep-sea ray-finned fish. Some authorities include the whalefishes as part of the order Stephanoberyciformes, within the superfamily **Cetomimoidea**.

Within the Cetomimiformes are five families and approximately 18 genera. Thought to have a circumglobal distribution throughout the tropical and temperate latitudes, whalefishes have been recorded at depths in excess of 3,500 metres. Their sister order, the Beryciformes, includes the flashlight fish and squirrelfish.

Named after their whale-shaped body (from the Greek ketos meaning "whale" or "sea monster", mimos meaning "imitative" and the Latin forma meaning "form"), the Cetomimiformes have extremely large mouths and highly distensible stomachs. Their eyes are very small or vestigial; the lateral line (composed of huge, hollow tubes) is consequently very well developed to compensate for life in the pitch black depths.

The dorsal and anal fins are set far back of the head; all fins lack spines. The swim bladder is also absent. Whalefish coloration is typically red to orange with a black body. Some species possess light-producing organs called photophores; these are typical of deep-sea fishes.

The largest known species reach a length of just 40 centimetres; most species are half this size. Sexual dimorphism is (apparently) exceptionally strong: males may only grow to 3.5 centimetres while females may be ten times as large. This could be said typical of deep-sea fishes, where the males serve little use other than as suppliers of sperm. A similar gender-to-size ratio is seen in deep-sea anglerfish.

Families

- Cetomimidae — flabby whalefishes
  Rondeletiidae — redmouth whalefishes
  Barbourisiidae — velvet whalefish (monotypic)
  Megalomycteridae — largenose fishes
  Mirapinnidae — hairyfish and tapetails (or ribbonbearers)

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Characiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Characiformes**
Families
Acestrorhynchidae
Alestiidae - African tetra
Anostomidae - Headstander
Characidae - Characin and tetra
Chilodontidae
Citharinidae
Crenuchidae
Ctenoluciidae - Pike-characid
Curimatidae
Cynodontidae
Distichodontidae
Erythrinidae - Trahira
Gasteropelecidae - Freshwater hatchetfish
Hemiodontidae
Hepsetidae
Lebiasinidae
Parodontidae
Prochilodontidae
Salminopsidae (extinct)
Serrasalmidae

The **Characiformes** are an order of ray-finned fish, comprising the characins and their allies. There are a few thousand different species, including the well-known piranha and tetras.

These belong within the superorder Ostariophysi, a group mainly distinguished by the presence of a Weberian apparatus, a series of bony parts connecting the swim bladder and inner ear. Superficially the Characiformes somewhat resemble their relatives the minnows. The most noticeable differences are the presence of a small fleshy adipose fin between the dorsal fin and tail, and the presence of teeth within the mouth, though there are exceptions to both of these. Barbels are always absent and the body is almost always covered in well-defined scales.

Characins are found in tropical lakes and rivers throughout most of South America, Central America, and central Africa. This and other evidence suggests they first diversified during the Cretaceous period, though fossils are poorly known. A few characins become quite large, and are important as food or game. Most, however, are small shoaling fish. Many species are popular in aquaria thanks to their bright colors, general hardiness, and tolerance towards other fish in community tanks.

Originally the characins were all grouped within a single family, the Characidae, which was included in the Cypriniformes. Since then about 15 different families have been separated out. However, classification varies somewhat, and it appears the circumscribed Characidae are still polyphyletic.

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Clupeiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Clupeiformes**
Families
Denticipitidae (denticle herring)
Engraulidae (anchovies)
Pristigasteridae (pristigasterids)
Chirocentridae (wolf herring)
Clupeidae (herrings)

Clupeiformes is the order of ray-finned fish that includes the herring family, Clupeidae, and the anchovy family, Engraulidae.

The order includes about 300 species in five families.

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Cypriniformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Cypriniformes**
Families

Suborder Cobitoidea

- Balitoridae (hillstream loaches)
- Catostomidae (suckers)
- Cobitidae (loaches)
- Gyrinocheilidae (algae eaters)

Suborder Cyprinoidea

- Cyprinidae (carps and minnows)

The **Cypriniformes** are an order of ray-finned fish, including the minnows and some related families. Historically these included all the forms now placed in the superorder Ostariophysi except the catfish, which were placed in the order Siluriformes. However, so defined the Cypriniformes are paraphyletic, and the orders Gonorhynchiformes, Characiformes (characins and allies), and Gymnotiformes (knifefishes and electric eels) have been separated out.

Aside from the features they share with the rest of the Ostariophysi, of which the Weberian apparatus is the most notable, the Cypriniformes are distinguished by having a single dorsal fin (most of the others have a second, fleshy adipose fin) and by having teeth in the throat rather than the mouth, called pharyngeal teeth.

The most notable family placed here is the Cyprinidae, the carps and minnows. This is the largest family of fish, with members found on all continents except Australia. A few species are found in brackish water, but almost all are found exclusively in freshwater. The other Cypriniformes include the Catostomidae, or suckers, and the Cobitidae, or loaches. The "Bala shark" (Balantiocheilus melanopterus) commonly found in home aquariums, is also a member.

References

- "Cypriniformes." *FishBase*. ed. Froese, R. and D. Pauly (03/2004),
- "Cypriniformes." *ITIS Standard Report*. (Integrated Taxonomic Information System: National Museum of Natural History, Washington, D.C., 2004-04-28).

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Cyprinodontiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Cyprinodontiformes,** Berg, 1940
Families
Anablepidae (four-eyed fish)
Aplocheilidae
Cyprinodontidae (pupfish)
Fundulidae
Goodeidae
Poeciliidae (live-bearers)
Profundulidae
Rivulidae
Valenciidae

The **Cyprinodontiformes** is an order of ray-finned fish, also called the **Microcyprini**, and comprising mostly small, fresh-water fish. They are closely related to the Atheriniformes and are occasionally included with them. Many popular aquarium fish, such as killifish and live-bearers, belong here.

Members of this order are notable for inhabiting harsh environments, such as saline or very warm waters, water of poor quality, or isolated situations where no other types of fish occur. They are typically omnivores, and often live near the surface, where the oxygen-rich water compensates for environmental disadvantages.

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Elopiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Elopiformes**

Families
Elopidae (tenpounders)
Megalopidae (tarpons)

Elopiformes is the order of ray-finned fish that includes the tarpons, tenpounders, and ladyfish, as well as a number of extinct types.

References

- "Elopiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. May 2006 version. N.p.: FishBase, 2006.

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Esociformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Superorder: Protacanthopterygii
Order: **Esociformes**
Families
Esocidae (pikes)
Umbridae (mudminnows)

Esociformes is a small order of ray-finned fish, with two families, the Umbridae (mudminnows) and the Esocidae (pikes). The pikes of genus *Esox* give the order its name. There are ten species--five in each family.

This order is closely related to the Salmoniformes, the two comprising the superorder Protacanthopterygii, and are often included in their order. The esociform fishes first appeared in the mid-Cretaceous -- early products of the Euteleost radiation of that time. Today they are found only in fresh water in North America and the northern Eurasian regions.

Pikes

The pikes tend to be lie-in-wait, ambush predators, with elongated snouts, long, well-muscled torsos, forked tails, and dorsal and anal fins set well back and opposite each other for rapid acceleration along a straight line, allowing the fish to quickly emerge from cover to capture its prey. Prey capture is facilitated by the impaling of the prey animal on the sharp teeth, after which the pike retreats to cover, turns the prey around, and swallows it, head first.

Anatomically, the pikes are characterized by the presence of shark-like, maxillary teeth, a mesocoracoid, and the absence of an adipose fin, breeding tubercules, and pyloric cecae.

The two more prominent species of Escoformidae are *Esox lucius,* or the northern pike, a popular sport fish that may reach lengths as great as a meter and a half, and the "muskie," *E. masquinongy*, which grows even larger.

Mudminnows

Mudminnows are much smaller than their pike cousins, with usual lengths of less than 20 cm. However, they are also extremely efficient, lie-in-wait, ambush predators, feeding mostly on the sorts of invertebrates commonly found in warm backwaters. Of the three North American species of genus *Umbra*, one, *U. limi*, possesses a limited capability for air breathing. *Umbra spp.* are most commonly found in the Atlantic coast regions of North America, along the marshy, low-oxygen areas of the Mississippi River, and in similar environments in Europe.

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Gadiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Gadiformes**
Families
Euclichthyidae (Eucla cod)
Lotidae
Macrouridae (grenadiers or rattails)
Moridae (morid cods or moras)
Melanonidae (pelagic cods)
Macruronidae (southern hakes)
Bregmacerotidae (codlets)
Muraenolepididae (eel cods)
Phycidae (phycid hakes)
Merlucciidae (merluccid hakes)
Gadidae (true cods)

Gadiformes is an order of ray-finned fish, also called the **Anacanthini**, that includes the cod and its allies. Many major food fish are in this order.

Common characteristics include the positioning of the pelvic fins (if present), below or anterior to the pectoral fins. The fins are spineless, and the gas bladder does not have a pneumatic duct.

Reference

- D.M. Cohen, T. Inada, T. Iwamoto and N. Scialabba, *FAO species catalogue*. Vol. 10. *Gadiform fishes of the world (Order Gadiformes). An annotated and illustrated catalogue of cods, hakes, grenadiers and other gadiform fishes known to date*. *FAO Fisheries Synopsis* 10 (125) (1990)
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Gasterosteiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Gasterosteiformes**
Families
Aulorhynchidae
Gasterosteidae
Hypoptychidae
Indostomidae
Pegasidae

Gasterosteiformes is an order of ray-finned fishes that includes the sticklebacks and sea moths.[1]

In the gasterosteiformes, the pelvic girdle is never attached to the cleithra directly, and the supramaxillary, orbitosphenoid, and basisphenoid bones are absent. The body is often partly or completely covered with dermal plates.

The name "Gasterosteiformes" means "stomach bone shaped"; it is derived from Greek gaster meaning "stomach", osteon meaning "bone" and Latin *forma* meaning "shape".

Classification

In Nelson[2] and ITIS[3] Gasterosteiformes includes the sea horses and pipefishes, as the suborder Syngnathoidei, with the sticklebacks and relatives in the suborder **Gasterosteoidei**. In FishBase[4] these groups are included in their own order, Syngnathiformes.

FishBase lists five families:

- Aulorhynchidae (tubesnouts and tubenoses)
  Gasterosteidae (sticklebacks)
  Hypoptychidae (sand eels)
  Indostomidae[5]
  Pegasidae (dragonfishes and sea moths)[5]

References

1. ^ "Gasterosteiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
2. ^ *Joseph S. Nelson. Fishes of the World. John Wiley & Sons. ISBN 0-471-54713-1.*
3. ^ Gasterosteiformes (TSN 166361). Integrated Taxonomic Information System. Accessed on 8 April 2006.
4. ^ "Syngnathiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
5. ^ ***a b*** Indostomidae and Pegasidae are included in Syngnathoidei (corresponding to Syngnathiformes) in ITIS, but in Gasterosteiformes in FishBase.

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Gobiesociformes

Clingfishes
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Gobiesociformes**
Family: **Gobiesocidae**
Genera
Acyrtops
Acyrtus
Alabes
Apletodon
Arcos
Aspasma
Aspasmichthys
Aspasmodes
Aspasmogaster
Chorisochismus
Cochleoceps
Conidens
Creocele
Dellichthys
Derilissus
Diademichthys
Diplecogaster
Diplocrepis
Discotrema
Eckloniaichthys
Gastrocyathus
Gastrocymba
Gastroscyphus
Gobiesox
Gouania
Gymnoscyphus
Haplocylix
Kopua
Lecanogaster
Lepadichthys
Lepadogaster
Liobranchia
Lissonanchus
Modicus

Opeatogenys
Parvicrepis
Pherallodichthys
Pherallodiscus
Pherallodus
Posidonichthys
Propherallodus
Rimicola
Sicyases
Tomicodon
Trachelochismus
See text for species.

Clingfishes are fishes of the family **Gobiesocidae**. Most species are marine, being found in shallow waters of the Atlantic, Pacific and Indian Oceans. They are bottom-dwelling fishes; some species shelter in sea urchins or crinoids. In most species the pelvic fins are modified into a sucking disc.[1]

Classification

The classification of the clingfishes varies. FishBase places Gobiescoidae the only family in the order **Gobiesociformes**;[2] Some other classifications, for example ITIS, place them in the suborder **Gobiesocoidei** of the order Perciformes.[3]

Species

FishBase lists about 150 species in 45 genera:[1]

- Genus *Acyrtops*
  - Flarenostril clingfish, Acyrtops amplicirrus Briggs, 1955.
    Emerald clingfish, Acyrtops beryllinus (Hildebrand & Ginsburg, 1926).
- Genus *Acyrtus*
  - Papillate clingfish, Acyrtus artius Briggs, 1955.
    Acyrtus pauciradiatus Sampaio, de Anchieta, Nunes & Mendes, 2004.
    Red clingfish, Acyrtus rubiginosus (Poey, 1868).
- Genus *Alabes*
  - Alabes brevis Springer & Fraser, 1976.
    Common shore-eel, Alabes dorsalis (Richardson, 1845).
    Dwarf shore-eel, Alabes hoesei Springer & Fraser, 1976.
    Pygmy shore-eel, Alabes parvulus (McCulloch, 1909).
- Genus *Apletodon*
  - Apletodon dentatus bacescui (Murgoci, 1940).
    Small-headed clingfish, Apletodon dentatus dentatus (Facciolà, 1887).
    Apletodon incognitus Hofrichter & Patzner, 1997.
    Apletodon microcephalus (Brook, 1890).
    Chubby clingfish, Apletodon pellegrini (Chabanaud, 1925).
- Genus *Arcos*
  - Elegant clingfish, Arcos decoris Briggs, 1969.
    Rockwall clingfish, Arcos erythrops (Jordan & Gilbert, 1882).
    Padded clingfish, Arcos macrophthalmus (Günther, 1861).
    Galapagos clingfish, Arcos poecilophthalmos (Jenyns, 1842).
    Rock clingfish, Arcos rhodospilus (Günther, 1864).
- Genus *Aspasma*
  - *Aspasma minima* (Döderlein, 1887).
- Genus *Aspasmichthys*
  - *Aspasmichthys ciconiae* (Jordan & Fowler, 1902).
- Genus *Aspasmodes*
  - *Aspasmodes briggsi* Smith, 1957.
- Genus *Aspasmogaster*
  - Eastern clingfish, Aspasmogaster costata (Ogilby, 1885).
    Smooth-snout clingfish, Aspasmogaster liorhyncha Briggs, 1955.

    - Aspasmogaster occidentalis Hutchins, 1984.
    - Tasmanian clingfish, Aspasmogaster tasmaniensis (Günther, 1861).
- Genus *Chorisochismus*
    - ○ Rocksucker, Chorisochismus dentex (Pallas, 1769).
- Genus *Cochleoceps*
    - ○ Cochleoceps bassensis Hutchins, 1983.
    - Western cleaner-clingfish, Cochleoceps bicolor Hutchins, 1991.
    - Eastern cleaner-clingfish, Cochleoceps orientalis Hutchins, 1991.
    - Cochleoceps spatula (Günther, 1861).
    - Green clingfish, Cochleoceps viridis Hutchins, 1991.
- Genus *Conidens*
    - ○ Conidens laticephalus (Tanaka, 1909).
    - Conidens samoensis (Steindachner, 1906).
- Genus *Creocele*
    - ○ Broad clingfish, Creocele cardinalis (Ramsay, 1883).
- Genus *Dellichthys*
    - ○ New Zealand urchin clingfish, Dellichthys morelandi Briggs, 1955.
- Genus *Derilissus*
    - ○ Derilissus altifrons Smith-Vaniz, 1971.
    - Whiskereye clingfish, Derilissus kremnobates Fraser, 1970.
    - Derilissus nanus Briggs, 1969.
    - Derilissus vittiger Fraser, 1970.
- Genus *Diademichthys*
    - ○ Urchin clingfish, Diademichthys lineatus (Sauvage, 1883).
- Genus *Diplecogaster*
    - ○ Two-spotted clingfish, Diplecogaster bimaculata bimaculata (Bonnaterre, 1788).
    - Diplecogaster bimaculata euxinica Murgoci, 1964.
    - Diplecogaster bimaculata pectoralis Briggs, 1955.
    - Diplecogaster ctenocrypta Briggs, 1955.
    - Bigeye clingfish, Diplecogaster megalops Briggs, 1955.
- Genus *Diplocrepis*
    - ○ Orange clingfish, Diplocrepis puniceus (Richardson, 1846).
- Genus *Discotrema*
    - ○ Crinoid clingfish, Discotrema crinophila Briggs, 1976.
- Genus *Eckloniaichthys*
    - ○ Weedsucker, Eckloniaichthys scylliorhiniceps Smith, 1943.
- Genus *Gastrocyathus*
    - ○ New Zealand slender clingfish, Gastrocyathus gracilis

Briggs, 1955.

- Genus *Gastrocymba*
  - *Gastrocymba quadriradiata* (Rendahl, 1926).
- Genus *Gastroscyphus*
  - Hector's clingfish, Gastroscyphus hectoris (Günther, 1876).
- Genus *Gobiesox*
  - Panamic clingfish, Gobiesox adustus Jordan & Gilbert, 1882.
    Clarion clingfish, Gobiesox aethus (Briggs, 1951).
    Lappetlip clingfish, Gobiesox barbatulus Starks, 1913.
    Socorro clingfish, Gobiesox canidens (Briggs, 1951).
    Gobiesox crassicorpus (Briggs, 1951).
    Gobiesox daedaleus Briggs, 1951.
    Lined clingfish, Gobiesox eugrammus Briggs, 1955.
    Mountain clingfish, Gobiesox fluviatilis Briggs & Miller, 1960.
    Gobiesox fulvus Meek, 1907.
    Peninsular clingfish, Gobiesox juniperoserrai Espinosa Pérez & Castro-Aguirre, 1996.
    Gobiesox juradoensis Fowler, 1944.
    Bahama skilletfish, Gobiesox lucayanus Briggs, 1963.
    Northern clingfish, Gobiesox maeandricus (Girard, 1858).
    Lonely clingfish, Gobiesox marijeanae Briggs, 1960.
    Gobiesox marmoratus Jenyns, 1842.
    Mexican clingfish, Gobiesox mexicanus Briggs & Miller, 1960.
    Gobiesox milleri Briggs, 1955.
    Gobiesox multitentaculus (Briggs, 1951).
    Gobiesox nigripinnis (Peters, 1860).
    Gobiesox nudus (Linnaeus, 1758).
    Bearded clingfish, Gobiesox papillifer Gilbert, 1890.
    Gobiesox pinniger Gilbert, 1890.
    Gobiesox potamius Briggs, 1955.
    Stippled clingfish, Gobiesox punctulatus (Poey, 1876).
    California clingfish, Gobiesox rhessodon Smith, 1881.
    Smoothlip clingfish, Gobiesox schultzi Briggs, 1951.
    Gobiesox stenocephalus Briggs, 1955.
    Skilletfish, Gobiesox strumosus Cope, 1870.
    Woods' clingfish, Gobiesox woodsi (Schultz, 1944).
- Genus *Gouania*
  - Blunt-snouted clingfish, Gouania willdenowi (Risso, 1810).
- Genus *Gymnoscyphus*
  - *Gymnoscyphus ascitus* Böhlke & Robins, 1970.
- Genus *Haplocylix*

    - Giant clingfish, Haplocylix littoreus (Forster, 1801).
- Genus *Kopua*
    - Kopua kuiteri Hutchins, 1991.
    - Kopua nuimata Hardy, 1984.
- Genus *Lecanogaster*
    - *Lecanogaster chrysea* Briggs, 1957.
- Genus *Lepadichthys*
    - Bolin's clingfish, Lepadichthys bolini Briggs, 1962.
    - Pale clingfish, Lepadichthys caritus Briggs, 1969.
    - Eyestripe clingfish, Lepadichthys coccinotaenia Regan, 1921.
    - Lepadichthys ctenion Briggs & Link, 1963.
    - Lepadichthys erythraeus Briggs & Link, 1963.
    - Lepadichthys frenatus Waite, 1904.
    - Doubleline clingfish, Lepadichthys lineatus (Sauvage, 1883).
    - Minor clingfish, Lepadichthys minor Briggs, 1955.
    - Lepadichthys sandaracatus Whitley, 1943.
    - Lepadichthys springeri Briggs, 2001.
- Genus *Lepadogaster*
    - Connemarra clingfish, Lepadogaster candolii Risso, 1810.
    - Shore clingfish, Lepadogaster lepadogaster (Bonnaterre, 1788).
    - Cornish sucker, Lepadogaster purpurea (Bonnaterre, 1788).
    - Lepadogaster zebrina Lowe, 1839.
- Genus *Liobranchia*
    - Minute clingfish, Liobranchia stria Briggs, 1955.
- Genus *Lissonanchus*
    - Streaky clingfish, Lissonanchus lusheri Smith, 1966.
- Genus *Modicus*
    - Modicus minimus (Döderlein, 1887).
    - Modicus tangaroa Hardy, 1983.
- Genus *Opeatogenys*
    - Opeatogenys cadenati Briggs, 1957.
    - Opeatogenys gracilis (Briggs, 1955).
- Genus *Parvicrepis*
    - Little clingfish, Parvicrepis parvipinnis (Waite, 1906).
- Genus *Pherallodichthys*
    - *Pherallodichthys meshimaensis* Shiogaki & Dotsu, 1983.
- Genus *Pherallodiscus*
    - Northern fraildisc clingfish, Pherallodiscus funebris (Gilbert, 1890).
    - Southern fraildisc clingfish, Pherallodiscus varius Briggs,

1955.

- Genus *Pherallodus*
    - Pherallodus indicus (Weber, 1913).
      Mini-clingfish, Pherallodus smithi Briggs, 1955.
- Genus *Posidonichthys*
    - *Posidonichthys hutchinsi* Briggs, 1993.
- Genus *Propherallodus*
    - *Propherallodus briggsi* (Smith, 1957).
- Genus *Rimicola*
    - Channel Islands clingfish, Rimicola cabrilloi Briggs, 2002.
      Southern clingfish, Rimicola dimorpha Briggs, 1955.
      Slender clingfish, Rimicola eigenmanni (Gilbert, 1890).
      Kelp clingfish, Rimicola muscarum (Meek & Pierson, 1895).
      Guadalupe clingfish, Rimicola sila Briggs, 1955.
- Genus *Sicyases*
    - Sicyases brevirostris (Guichenot, 1848).
      Sicyases hildebrandi Schultz, 1944.
      Sicyases sanguineus Müller & Troschel, 1843.
- Genus *Tomicodon*
    - Distant clingfish, Tomicodon absitus Briggs, 1955.
      Tomicodon abuelorum Szelistowski, 1990.
      Tomicodon australis Briggs, 1955.
      Bifid clingfish, Tomicodon bidens Briggs, 1969.
      Cortez clingfish, Tomicodon boehlkei Briggs, 1955.
      Tomicodon briggsi (Smith, 1957).
      Smallsucker clingfish, Tomicodon chilensis Brisout de Barneville, 1846.
      Tomicodon clarkei Williams & Tyler, 2003.
      Tomicodon cryptus Williams & Tyler, 2003.
      Rosy clingfish, Tomicodon eos (Jordan & Gilbert, 1882).
      Barred clingfish, Tomicodon fasciatus (Castelnau, 1861).
      Sonora clingfish, Tomicodon humeralis (Gilbert, 1890).
      Tomicodon lavettsmithi Williams & Tyler, 2003.
      Tomicodon leurodiscus Williams & Tyler, 2003.
      Blackstripe clingfish, Tomicodon myersi Briggs, 1955.
      Peter's clingfish, Tomicodon petersii (Garman, 1875).
      Tomicodon prodomus Briggs, 1969.
      Tomicodon reitzae Briggs, 2001.
      Tomicodon rhabdotus Smith-Vaniz, 1969.
      Tomicodon rupestris (Poey, 1860).
      Tomicodon vermiculatus Briggs, 1955.
      Zebra clingfish, Tomicodon zebra (Jordan & Gilbert, 1882).

- Genus *Trachelochismus*
  - Striped clingfish, Trachelochismus melobesia Phillipps, 1927.

    New Zealand lumpfish, Trachelochismus pinnulatus (Forster, 1801).

References

1. ^ *a* *b* "Gobiesocidae". *FishBase*. Ed. Ranier Froese and Daniel Pauly. May 2006 version. N.p.: FishBase, 2006.
2. ^ "Gobiesociformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. May 2006 version. N.p.: FishBase, 2006.
3. ^ Gobiesociformes (TSN 164456). Integrated Taxonomic Information System. Accessed on 21 June 2006.

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Gonorynchiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Gonorynchiformes**
Families
Chanidae (milkfish)
Gonorynchidae (beaked salmons)
Kneriidae (shellears)
Phractolaemidae (hingemouths)

Gonorynchiformes is an order of ray-finned fish that includes the important food source, the milkfish (*Chanos chanos*, family Chanidae), and a number of lesser-known types, both marine and freshwater.

The alternate spelling "Gonorhynchiformes", with an "h", is frequently seen but not official.

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Gymnotiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Gymnotiformes**
Families
Apteronotidae (ghost knifefishes)
Eigenmanniidae (obsolete?)
Gymnotidae
(naked-back knifefishes and electric eels)
Hypopomidae
Rhamphichthyidae
Sternopygidae

The **Gymnotiformes** is a lineage of ostariophysan teleost electric fishes. They are primarily freshwater inhabitants and have organs adapted to the generation of electric fields. All gymnotiform species generate weak (<1 V) electric fields, using them for navigation and communication. The electric discharge is continuous, being generated day and night throughout the entire life of the individual.

Certain aspects of the electric signal are unique to each species. The best-known species is the electric eel (Electrophorus electricus) which uses powerful electric shocks (up to 600 V) for hunting and self-defense. Other species familiar in the aquarium trade are: the black ghost ("Apteronotus albifrons"), the glass knifefish ("Eigenmannia virescens"), and the tiger knifefish "Gymnotus carapo").

Common names found in the literature include the **Neotropical electric fishes**, 'South American electric fishes, or **American knifefishes**. Gymnotiform fishes inhabit freshwater rivers and streams throughout the humid Neotropics, ranging from Guatemala to Northern Argentina. There are currently about 185 known species, of which 50 or so are yet to be formally described. The actual number of species in the wild is unknown.

See also

- Electric fish
-

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Hiodontiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Hiodontiformes**
Families: Hiodontidae (mooneyes)

Hiodontiformes is a relatively new order of fish, consisting of the two living species of the mooneye family Hiodontidae and three genera of extinct types.

These are traditionally classified with the Osteoglossiformes, and many authorities still do, but fossil study of the extinct *Yanbiania* suggest that the hiodontids separated from other osteoglossiforms early, and thus belong to a separate order.

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Lampriformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Lampriformes**
Families
Turkmenidae (extinct)
Veliferidae (velifers)
Lamprididae (opahs)
Stylephoridae (tube-eye/thread-tail)
Lophotidae (crestfishes)
Radiicephalidae (tapertail)
Trachipteridae (ribbonfishes)
Regalecidae (oarfishes)

Lampriformes (also spelt **Lampridiformes**) are an order of ray-finned fish that includes about 50 living species of deep sea fishes, including the opahs, crestfishes, ribbonfishes, and oarfish. These are acanthomorph teleosts which diverged at the end of the Cretaceous or in the succeeding Paleocene period, 60-70 million years ago. Their sister order is the Myctophiformes.

Lampriforms have a highly variable body form, but they are usually deep-bodied or elongate. The premaxilla completely excludes the maxilla from the gape. However, the jaws are highly protrusible, with a unique type of protrusible upper jaw. The maxilla, instead of being ligamentously attached to the ethmoid and palatine, slides in and out with the highly protractile premaxilla. The lampridiforms have 84-96 total vertebrae, but lack fin spines. The pelvic fins have 0-17 rays and are placed rather far toward the front of the animal. The dorsal fins are long, and tend to run most of the length of the body. They lack scales. The fishes are normally found at depth 100-1000 m but are pelagic, not bottom feeders.

References

- "Lampriformes". *FishBase.* Ed. Ranier Froese and Daniel Pauly. February 2005 version. N.p.: FishBase, 2005.

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Lepisosteiformes

Gars

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Lepisosteiformes**
Family: **Lepisosteidae**
Species
Atractosteus spatula
Atractosteus tristoechus
Atractosteus tropicus
Lepisosteus oculatus
Lepisosteus osseus
Lepisosteus platostomus
Lepisosteus platyrhincus

In American English the name **gar** (or **garpike**) is strictly applied to members of the **Lepisosteidae**, a family including seven living species of fish in two genera that inhabit fresh, brackish, and occasionally marine, waters of eastern North America, Central America, and the Caribbean islands. In British English the name gar was originally used for a species of needlefish, Belone belone, found in the North Atlantic. Further confusing matters, in both American and British English, some species of halfbeak are sometimes also called gar or garpikes. This article is concerned with the true gars of the family Lepisosteidae.

The gars are members of the **Lepisosteiformes** (or **Semionotiformes**), an ancient order of "primitive" ray-finned fish; fossil gars are known from the Permian onwards. Fossil gars are found in both Europe and North America, indicating that in Cretaceous and Tertiary times these fish had a wider distribution than they do today. Gars are considered to be among the most primitive bony fish and are most closely related to the bowfin, another archaic fish now found only in North America.

Gar bodies are elongate, heavily armored with ganoid scales, and fronted by similarly elongate jaws filled with long sharp teeth. Tails are heterocercal, and the dorsal fins are close to the tail. They have vascularised swim bladders that can function as lungs, and most gar surface periodically to take a gulp of air, doing so more frequently in stagnant or warm water when the concentration of oxygen in the water is low. As a result, they are extremely hardy and able to tolerate conditions that would kill most other fish.

All the gars are relatively big fish, but the alligator gar *Atractosteus* *spatula* is the champion, as specimens having been recorded up to 3 meters in length. Even the smaller species, such as *Lepisosteus oculatus*, are large, commonly reaching lengths of over 60 cm, and sometimes much more.

Gar tend to be slow, preferring shallow weedy areas of rivers, lakes, and bayous, but they are voracious predators, catching fish and crustaceans with their needle-like teeth. They are most abundant in tropical to subtropical freshwater, but several species are found in the more temperate parts of North America as far as southern Canada (for example *Lepisosteus osseus*). Most species inhabit brackish water in parts of their range, but only relatively few, most notably *Atractosteus tristoechus*, are regularly found in fully marine conditions.

Gar flesh is edible, and sometimes available in markets, but unlike the sturgeon that they resemble, gar roe is poisonous.

Gar in aquaria

Gar are popular fish for public aquaria where they are often kept alongside other large, "archaic" fish such as sturgeon and paddlefish. However, a few species, most commonly *Lepisosteus oculatus*, are sometimes offered to aquarists as pets. They do of course need very large tanks but in all other regards they are easy to keep. They are not much bothered by water quality or chemistry, and are tolerant of a wide range of temperatures. Gar must be allowed to breathe air, so some clearance between the surface of the water and the hood is essential.

Gar get on well with any other fish too big to be eaten (such as large catfish, cichlids, and centrachids). They do not like aggressive tankmates, and despite being predators are essentially peaceable, sociable fish that do well with their own kind. Sturdy aquarium plants and bogwood can also be used to create hiding places, since gars are very fond of lurking in slightly shady regions.

Feeding presents no problems. Most will take all kinds of meaty foods, including mealworms, crickets, earthworms, frozen lancefish and shrimps (defrosted), and strips of squid. Oily fish (like salmon and mackerel) as well as fish guts will quickly pollute an aquarium but are very effective at tempting newly introduced specimens to eat. Once settled in many specimens will also eat floating pellets as well. There is no nutritional reason to feed gar live fish, and cheap goldfish or guppies ("feeder fish") in particular tend to introduce parasites into an aquarium.

Gar diversity

Genus *Atractosteus*:

- Alligator gar Atractosteus spatula (305 cm)
  Cuban gar Atractosteus tristoechus (200 cm)
  Tropical gar Atractosteus tropicus (125 cm)

Genus *Lepisosteus*:

- Spotted gar Lepisosteus oculatus (112 cm)
  Longnose gar Lepisosteus osseus (200 cm)
  Shortnose gar Lepisosteus platostomus (88 cm)
  Florida gar Lepisosteus platyrhincus (132 cm)
-

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Lophiiformes

Anglerfishes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Lophiiformes**
Suborders
Antennarioidei
Lophioidei
Ogcocephalioidei
See text for families.

Anglerfishes are bony fishes in the order **Lophiiformes**.[1]

An anglerfish has a head of enormous size, broad, flat and depressed, with the remainder of the body appearing merely like an appendage. Anglerfish may grow to a length of 200 cm (6.5 feet); specimens of 90 cm (3 ft.) are common. It's maximum weight is 30 kilos (1000 US ounces)

Anglerfishes are, for the most part, deep-sea fishes, though there are some families that have shallow-water representatives, including one, the frogfishes (family Antennariidae), that occurs only in shallow water. Examples of other anglerfish families that have some shallow water species are the goosefishes (family Lophiidae) and the batfishes (family Ogcocephalidae). These families also have deep water representatives. The deep-sea mid-water anglerfishes belong to the superfamily Ceratioidea.

The order was formerly known as **Pediculati**.

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- 1 Predation
- 2 Reproduction
- 3 Consumption
- 4 References

Predation

Anglerfishes are named for their characteristic method of predation, Angler being another word for fisherman. The anglerfish has three long filaments sprouting from the middle of its head; these are the detached and modified three first spines of the anterior dorsal fin. As with all anglerfish species, the longest filament is the first (the illicium). This first spine protudes above the fish's eyes, and terminates in an irregular growth of flesh (the esca) at the tip of the spine. The spine is movable in all directions, and the esca can be wiggled so as to resemble a prey animal, and thus to act as bait to lure other predators close enough for the anglerfish to devour them whole. The jaws are triggered in automatic reflex by contact with the tentacle. (The netdevil anglerfish has similar growths protruding from its chin as well.)

As most anglerfish live mainly in the oceans' aphotic zones, where the water is too deep for sunlight to penetrate, their predation relies on the "lure" being bioluminescent (via bacterial symbiosis). In a related adaptation, anglerfish are dull gray, dark brown or black, and are thus not visible either in their own light or in that of similarly luminescent prey.[2]

The wide mouth extends all around the anterior circumference of the head, and both jaws are armed with bands of long pointed teeth, which are inclined inwards, and can be depressed so as to offer no impediment to an object gliding towards the stomach, but to prevent its escape from the mouth. The anglerfish is able to distend both its jaw and its stomach (its bones are thin and flexible) to enormous size, allowing it to swallow prey up to twice as large as its entire body.

Some benthic (bottom-dwelling) forms have arm-like pectoral fins which the fish use to walk along the ocean floor. The pectoral and ventral fins are so articulated as to perform the functions of feet, the fish being enabled to move, or rather to walk, on the bottom of the sea, where it generally hides itself in the sand or amongst sea-weed. All around its head and also along the body the skin bears fringed appendages resembling short fronds of sea-weed, a structure which, combined with the extraordinary faculty of assimilating the colour of the body to its surroundings, assists this fish greatly in concealing itself in places which it selects on account of the abundance of prey.

Reproduction

Ceratiidae: Krøyer's deep sea angler fish, *Ceratias holboelli*

Some anglerfish have a unique mating method. Since individuals are rare and encounters doubly so, finding a mate is a problem, especially at a time when both individuals are ready to spawn. When scientists first started capturing ceratioid anglerfish, they noticed that all of the specimens were females. These individuals were a few inches in size and almost all of them had what appeared to be parasites attached to them. It turned out that these "parasites" were the remains of male ceratioids.

When a male of one of these species hatches, it is equipped with extremely well developed olfactory organs that detect scents in the water. They have no digestive system, and thus are unable to feed independently. They must find a female anglerfish, and quickly, or else they will die. The sensitive olfactory organs help him to detect the pheromones that signal the proximity of a female anglerfish. When he finds a female, he bites into her flank, and releases an enzyme which digests the skin of his mouth and her body, fusing the pair down to the blood vessel level. The male then atrophies into nothing more than a pair of gonads that release sperm in response to hormones in the female's bloodstream indicating egg release. This is an extreme example of sexual dimorphism. However, it ensures that when the female is ready to spawn, she has a mate immediately available.[2]

The spawn of the angler is very remarkable. It consists of a thin sheet of transparent gelatinous material 2 or 3 ft. broad and 25 to 30 ft. in length. The eggs in this sheet are in a single layer, each in its own little cavity. The spawn is free in the sea. The larvae are free-swimming and have the pelvic fins elongated into filaments.

Consumption

In Europe, the tail meat is widely used in cooking and is often compared to lobster tail in taste and texture. It is therefore sometimes referred to as "poor man's lobster." The anglerfish is a culinary speciality in certain Asian countries. In Japan each fish sells for as much as USD$150. The liver alone, considered a great delicacy, can cost USD$100.

References

1. ^ "Lophiiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
2. ^ ***a b*** Ramsey Doran. Deep sea anglerfish. Retrieved on 3 April 2006.

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Mugiliformes

Mullets

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Mugiliformes**
Family: **Mugilidae**
Genera

Agonostomus
Aldrichetta
Cestraeus
Cahaenomugil
Chelon
Crenimugil
Joturus
Liza
Moolgarda
Mugil
Myxus
Neomyxus
Oedalechilus
Rhinomugil
Sicamugil
Valaomugil
Xenomugil

The **mullets** are a family (**Mugilidae**) of ray-finned fish found worldwide in coastal temperate and tropical waters, and in some species in fresh water also. Mullets have served as an important source of food in Mediterranean Europe since Roman times. The family includes about 80 species in 17 genera.

Taxonomically, the family is usually treated as the sole member of the order **Mugiliformes**, but as Nelson says, "there has been much disagreement concerning the relationships" of this family. The presence of fin spines clearly indicates membership in the superorder Acanthopterygii, and in the 1960s Gosline classed them as primitive perciforms, while others have grouped them in Atheriniformes. FishBase follows Gosline in placing the family in the Perciformes.

A number of species of the goatfishes (Mullidae), in particular the red mullet and others in the genus Mullus, are also commonly known as "mullets".

List of Species

- Genus *Agonostomus*
  - Agonostomus catalai
    Mountain mullet Agonostomus monticola
    Fairy mullet Agonostomus telfairii
- Genus *Aldrichetta*
  - Yellow-eye mullet *Aldrichetta forsteri*
- Genus *Cestraeus*
  - Goldie river mullet Cestraeus goldiei
    Sharp-nosed river mullet Cestraeus oxyrhynchus
    Lobed river mullet Cestraeus plicatilis
- Genus *Cahaenomugil*
  - Snouted mullet *Chaenomugil proboscideus*
- Genus *Chelon*
  - Cape Verde mullet Chelon bispinosus
    So-iny mullet Chelon haematocheilus
    Thicklip grey mullet Chelon labrosus
    Largescale mullet Chelon macrolepis
- Genus *Crenimugil*
  - Fringelip mullet Crenimugil crenilabis
    Half fringelip mullet Crenimugil heterocheilos
- Genus *Joturus*
  - Bobo mullet *Joturus pichardi*
- Genus *Liza*
  - Abu mullet Liza abu
    Eastern keelback mullet Liza affinis
    Diamond mullet Liza alata
    Flat-tail mullet Liza argentea
    Golden grey mullet Liza aurata
    Keeled mullet Liza carinata
    Grooved mullet Liza dumerili
    Sicklefin mullet Liza falcipinnis
    Largescaled mullet Liza grandisquamis
    Klunzinger's mullet Liza klunzingeri
    Liza mandapamensis
    Otomebora mullet Liza melinoptera
    Broad-mouthed mullet Liza parmata
    Gold-spot mullet Liza parsia
    Persian mullet Liza persicus
    Thinlip mullet Liza ramado
    Ramsay's mullet Liza ramsayi
    South African mullet Liza richardsonii

    Leaping mullet Liza saliens
    Greenback mullet Liza subviridis
    Tade mullet Liza tade
    Striped mullet Liza tricuspidens
    Squaretail mullet Liza vaigiensis

- Genus *Moolgarda*
  - Longfin mullet *Moolgarda pedaraki*
- Genus *Mugil*
  - Banana mullet Mugil bananensis
    Broussonnet's mullet Mugil broussonnetii
    Narrowhead grey mullet Mugil capurrii
    Flathead mullet Mugil cephalus
    White mullet Mugil curema
    Dwarf mullet Mugil curvidens
    Galapagos mullet Mugil galapagensis
    Fantail mullet Mugil gyrans
    Hospe mullet Mugil hospes
    Parassi mullet Mugil incilis
    Liza Mugil liza
    Mugil platanus
    Mullet Mugil rammelsbergii
    Liseta mullet Mugil setosus
    So-iuy mullet Mugil soiuy
    Mugil trichodon
- Genus *Myxus*
  - Freshwater mullet Myxus capensis
    Sand grey mullet Myxus elongatus
    Myxus multidens
    Myxus petardi
- Genus *Neomyxus*
  - Neomyxus chaptalii
    Acute-jawed mullet Neomyxus leuciscus
- Genus *Oedalechilus*
  - Boxlip mullet Oedalechilus labeo
    Hornlip mullet Oedalechilus labiosus
- Genus *Rhinomugil*
  - Corsula Rhinomugil corsula
    Shark mullet Rhinomugil nasutus
- Genus *Sicamugil*
  - Yellowtail mullet Sicamugil cascasia
    Burmese mullet Sicamugil hamiltonii
- Genus *Valaomugil*
  - Bluetail mullet Valamugil buchanani
    Longarm mullet Valamugil cunnesius

Kanda Valamugil engeli
Valamugil formosae
Silver mullet Valamugil georgii
Valamugil perusii
Robust mullet Valamugil robustus
Bluespot mullet Valamugil seheli
Speigler's mullet Valamugil speigleri

- Genus *Xenomugil*
    - Thoburn's mullet *Xenomugil thoburni*

The Striped or Black Mullet is a delicacy along the Northwest Florida and Alabama gulf coast. Many restaurants in those areas serve mullet as the mainstay of their menus. Fried mullet are the most popular. Smoked, baked, and canned mullet are also eaten. Mullet is usually fileted. The left over frames are often used to make excellent fish stock. The stock makes superb chowders, stews, and bouillabaisse.

Mullet does not keep well after it is caught. If kept on ice it may remain edible for approximately 24 hours. If kept much longer it begins to loose its freshness and becomes nearly inedible. The sooner it can be eaten after being caught, the better.

When shopping for mullet for consumption, choose only those fish with clear eyes. Cloudy eyes are indicators of loss of freshness.

Reference

- J.S. Nelson, *Fishes of the World*

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Myctophiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Myctophiformes**
Families
Neoscopelidae
Myctophidae

Myctophiformes is an order of ray-finned fish consisting of two families of deep-sea marine fish, most notably the highly abundant lanternfishes (Myctophidae).

The order is similar to Aulopiformes, but the pharyngobranchial structure is more standard.

References

- "Myctophiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. January 2006 version. N.p.: FishBase, 2006.
- J. S. Nelson, *Fishes of the World*

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Notacanthiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Notacanthiformes**
Families
Halosauridae
Notacanthidae

Notacanthiformes is an order of deep-sea ray-finned fishes, consisting of the families Halosauridae and Notacanthidae (spiny eels)

The order is of relatively recent vintage; *Fishes of the World* lists it as a suborder **Notacanthoidei** of Albuliformes. The notacanthiforms are much more eel-like than the albuliforms; for instance, the caudal fin has disappeared.

References

- Joseph S. Nelson. *Fishes of the World. John Wiley & Sons. ISBN 0-471-54713-1*.

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Ophidiiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Ophidiiformes**
Families
Carapidae
Ophidiidae
Bythitidae
Aphyonidae
Parabrotulidae

Ophidiiformes is an order of ray-finned fish that includes the cusk eels (family Ophidiidae), pearlfishes (family Carapidae), brotulas (family Bythitidae), and others.

This order includes a variety of deep-sea species, including the deepest known, Abyssobrotula galatheae, found at 8,370 m in the Puerto Rico Trench.

The families Ranicipitidae (tadpole cods) and Euclichthyidae (eucla cods) were formerly classified in this order, but are now preferred in Gadiformes; Ranicipitidae has been absorbed within the family Gadidae.

References

- J.G. Nielsen, D.M. Cohen, D.M. Markle, C.R. Robins, *Ophidiiform fishes of the world (Order Ophidiiformes): An annotated and illustrated catalogue of pearlfishes, cusk-eels, brotulas and other ophidiiform fishes known to date* (FAO, 1999)

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Osmeriformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Osmeriformes**
Suborders
Argentinoidei
Osmeroidei
See text for families.

Osmeriformes is an order of ray-finned fish that includes various kinds of smelts, noodlefishes, and the odd-looking barreleyes. The order consists of fourteen families with about 240 species total.

Characteristics of the order include the maxilla in the gape of the mouth, radii absent from the scales, and loss of the basisphenoid and orbitosphenoid bones. Almost all osmeriforms spawn in fresh water, but many are anadromous and found in temperate oceans worldwide.

The Argentinoidei are characterized by the presence of a crumenal organ, consisting of additional cartilage and gill rakers on the 5th ceratobranchial, while the Osmeroidea are notable for having their eggs surrounded by an adhesive membrane. Some classifications split the Argentinoidei genera Holtbyrnia, Maulsia, and Pellisolus out of the Platytroctidae family and into their own family called Searsiidae.

Classification

- Suborder Argentinoidei
    - Superfamily Alepocephaloidea
        - Alepocephalidae (slickheads)
        Leptochilichthyidae
        Platytroctidae
    - Superfamily Argentinoidea
        - Argentinidae (herring smelts)
        Bathylagidae (deep-sea smelts)
        Microstomatidae
        Opisthoproctidae (barreleyes)
- Suborder Osmeroidei
    - Superfamily Galaxoidea
        - Galaxiidae
        Lepidogalaxiidae (salamanderfishes)
        Retropinnidae (New Zealand smelts)
    - Superfamily Osmeroidea
        - Osmeridae (smelts)
        Plecoglossidae (ayu fishes)
        Salangidae (noodlefishes)

References

- "Osmeriformes". *FishBase.* Ed. Ranier Froese and Daniel Pauly. January 2006 version. N.p.: FishBase, 2006.
- J. S. Nelson, *Fishes of the World*

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Osteoglossiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Osteoglossiformes**
Families
Gymnarchidae
Heterotididae
Mormyridae (elephantfishes)
Notopteridae (featherfin knives)
Ostariostomidae (extinct)
Osteoglossidae (arowana)
Pantodontidae (butterflyfishes)
Singididae (extinct)

Osteoglossiformes (Lat. "bony tongues") is a relatively primitive order of ray-finned fish that contains two sub-orders the Osteoglossoidei and the Notopteroidei

Members of the order are notable for having toothed or bony tongues, and for having the forward part of the gastrointestinal tract pass to the left of the oesophagus and stomach (for all other fish it passes to the right).

One species, the arapaima (Arapaima gigas) is the largest freshwater fish known, with specimens reported up to 4.5 m in length.

The mooneyes (Hiodontidae) are often classified here, but may also be placed in a separate order Hiodontiformes.

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Perciformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Perciformes**
Families: *many, see text*

The **Perciformes**, also called the **Percomorphi** or **Acanthopteri**, include about 40% of all fish and are the largest order of vertebrates. The name *Perciformes* means perch-like. They belong to the ray-finned fish and comprise over 7000 different species, with varying shapes and sizes, found in almost all aquatic environments. They first appeared and diversified in the Late Cretaceous.

Perciform fish typically have dorsal and anal fins divided into anterior spiny and posterior soft-rayed portions, which may be partially or completely separated. There are usually pelvic fins with one spine and up to five soft rays, either positioned by the throat or under the belly. Scales are usually ctenoid in form, though sometimes they are cycloid or otherwise modified. Various other, more technical characters define the group.

Classification is controversial. As traditionally defined the Perciformes are almost certainly paraphyletic. Other orders that should possibly be included as suborders are the Scorpaeniformes, Tetraodontiformes, and Pleuronectiformes. Of the presently recognized suborders several may be paraphyletic as well.

Families

These are grouped by suborder/superfamily, generally following *Fishes of the World*.

- Suborder Percoidei
  - Superfamily Percoidea
    - Acropomatidae (temperate ocean-basses)
    - Ambassidae (Asiatic glassfishes)
    - Apogonidae (cardinalfishes)
    - Arripidae (Australasian salmon)
    - Banjosidae
    - Bathyclupeidae
    - Bramidae (pomfrets)
    - Callanthiidae
    - Carangidae (jacks, pompanos)
    - Caristiidae (manefishes)
    - Centracanthidae
    - Centrarchidae (freshwater sunfishes)
    - Centropomidae (snooks)
    - Chaetodontidae (butterflyfishes)
    - Coryphaenidae (dolphinfishes)
    - Dichistiidae (galjoen fishes)
    - Dinolestidae (long-finned pike)
    - Dinopercidae
    - Drepaneidae
    - Echeneidae (remoras)
    - Emmelichthyidae (rovers)
    - Enoplosidae (oldwife)
    - Epigonidae (deepwater cardinalfishes)
    - Gerreidae (mojarras)
    - Glaucosomatidae (pearl perches)
    - Grammatidae (basslets)
    - Haemulidae (grunts)
    - Inermiidae (bonnetmouths)
    - Kuhliidae (flagtails or aholeholes)
    - Kyphosidae (sea chubs)
    - Lactariidae (false trevallies)
    - Leiognathidae (ponyfishes)
    - Leptobramidae (beachsalmon)
    - Lethrinidae
    - Lobotidae (tripletails)
    - Lutjanidae (snappers, fusiliers)
    - Malacanthidae (Tilefishes)

    - Menidae (moonfish)
    - Monodactylidae (moonyfishes)
    - Moronidae (temperate basses)
    - Mullidae (goatfishes)
    - Nandidae (leaffishes)
    - Nematistiidae (roosterfish)
    - Nemipteridae (threadfin breams)
    - Notograptidae
    - Opistognathidae (jawfishes)
    - Oplegnathidae (knifejaws)
    - Ostracoberycidae
    - Pempheridae (sweepers)
    - Pentacerotidae (armorheads)
    - Percichthyidae (Temperate perches)
    - Percidae (perches and darters)
    - Plesiopidae
    - Polycentridae
    - Polynemidae (threadfins)
    - Polyprionidae (wreckfishes)
    - Pomacanthidae (angelfishes)
    - Pomatomidae (bluefishes)
    - Priacanthidae (bigeyes, catalufas)
    - Pseudochromidae (dottybacks)
    - Rachycentridae (cobia)
    - Sciaenidae (drums)
    - Scombropidae (gnomefish)
    - Serranidae (sea basses, groupers)
    - Sillaginidae (whitings et al)
    - Sparidae (porgies)
    - Terapontidae (grunters or tigerperches)
    - Toxotidae (archerfishes)
  - Superfamily Cirrhitoidea
    - Aplodactylidae (marblefishes)
    - Cheilodactylidae (morwongs)
    - Chironemidae (kelpfishes)
    - Cirrhitidae (hawkfishes)
    - Latridae (trumpeters)
  - Superfamily Cepoloidea
    - Cepolidae (bandfishes)
- Suborder Elassomatoidei
  - Elassomatidae (pygmy sunfishes)
- Suborder Labroidei
  - Cichlidae (cichlids)
  - Embiotocidae (surfperches)

  - Labridae (wrasses)
  - Odacidae
  - Pomacentridae (damselfishes)
  - Scaridae (parrotfishes)
- Suborder Zoarcoidei
  - Anarhichadidae
  - Bathymasteridae (ronquils)
  - Cryptacanthodidae
  - Pholidae
  - Ptilichthyidae
  - Scytalinidae
  - Stichaeidae (pricklebacks)
  - Zaproridae (prowfish)
  - Zoarcidae (eelpouts)
- Suborder Notothenioidei
  - Bathydraconidae
  - Bovichthyidae
  - Channichthyidae (crocodile icefishes)
  - Harpagiferidae (plunderfishes)
  - Nototheniidae
- Suborder Trachinoidei
  - Ammodytidae (sand lances)
  - Champsodontidae
  - Cheimarrhichthyidae
  - Chiasmodontidae
  - Creediidae (sandburrowers)
  - Leptoscopidae
  - Percophidae (duckbills)
  - Pholidichthyidae (convict blenny)
  - Pinguipedidae (sandperches)
  - Trachinidae (weeverfishes)
  - Trichodontidae (sandfishes)
  - Trichonotidae (sanddivers)
  - Uranoscopidae (stargazers)
- Suborder Blennioidei
  - Blenniidae
  - Chaenopsidae
  - Clinidae
  - Dactyloscopidae
  - Labrisomidae
  - Tripterygiidae
- Suborder Icosteoidei
  - Icosteidae (ragfishes)
- Suborder Gobiesocoidei

    - Gobiesocidae (clingfishes)
- Suborder Callionymoidei
    - Callionymidae (dragonets)
    - Draconettidae
- Suborder Gobioidei
    - Eleotridae (sleepers)
    - Gobiidae (gobies)
    - Kraemeriidae (sandfishes or sand gobies)
    - Microdesmidae (wormfishes)
    - Odontobutidae
    - Ptereleotridae (dartfishes)
    - Rhyacichthyidae (loach gobies)
    - Schindleriidae
    - Xenisthmidae
- Suborder Kurtoidei
    - Kurtidae (nurseryfishes)
- Suborder Acanthuroidei
    - Acanthuridae (surgeonfishes)
    - Ephippidae (spadefishes)
    - Luvaridae (louvar)
    - Scatophagidae (scats)
    - Siganidae (rabbitfishes)
    - Zanclidae (moorish idol)
- Suborder Scombrolabracoidei
    - Scombrolabracidae
- Suborder Scombroidei
    - Sphyraenidae (barracudas)
    - Gempylidae (snake mackerels)
    - Trichiuridae (cutlassfishes)
    - Scombridae (mackerels and tunas)
    - Xiphiidae (billfishes)
- Suborder Stromateoidei
    - Amarsipidae
    - Ariommatidae
    - Centrolophidae (medusafishes)
    - Nomeidae (driftfishes)
    - Tetragonuridae (squaretails)
    - Stromateidae (butterfishes)
- Suborder Anabantoidei
    - Anabantidae (climbing gouramies)
    - Belontiidae (gouramies)
    - Helostomatidae (kissing gourami)
    - Luciocephalidae (pikehead)
    - Osphronemidae (giant gouramies)

- Suborder Channoidei
    - Channidae (snakeheads)

References

- J. S. Nelson, *Fishes of the World* (3rd ed.)

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Percopsiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Percopsiformes**
Families: See text.

Percopsiformes is a small order of ray-finned fish, comprising the trout-perch and its allies.

Families

- Percopsidae (trout-perches)
  Aphredoderidae (pirate perches)
  Amblyopsidae (cavefishes)

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Pleuronectiformes

Flatfish

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Pleuronectiformes**
Families

Suborder Psettodoidei

Psettodidae

Suborder Pleuronectoidei

Citharidae
Scophthalmidae (turbots)
Bothidae (lefteye flounders)
Pleuronectidae (righteye flounders)
Paralichthyidae (large-tooth flounders)
Achiropsettidae (southern flounders)
Samaridae

Suborder Soleoidei

Soleidae (soles)
Achiridae (American soles)
Cynoglossidae (tonguefishes)

The **flatfish** are an order (**Pleuronectiformes**) of ray-finned fish, also called the Heterosomata, sometimes classified as a suborder of Perciformes. The name means "side-swimmers" in Greek. In many species both eyes lie on one side of the head, one or the other migrating through and around the head during development. Some species face their "left" side upward, some face their "right" side upward, and others face either side upward. The other distinguishing features of the order are the presence of protrusible eyes, another adaptation to living on the sea-bed (benthos), and the extension of the dorsal fin onto the head.

Many important food fish are in this order, including the flounders, soles, turbot, plaice, and halibut. There are more than 400 species of this order. Some flatfish can camouflage themselves on the ocean floor.

Flatfish have been cited as dramatic examples of evolutionary adaptation. For example, Richard Dawkins in The Blind Watchmaker, explains the flatfish's evolutionary history as:

> ... bony fish as a rule have a marked tendency to be flattened in a vertical direction.... It was natural, therefore, that when the ancestors of [flatfish] took to the sea bottom, they should have lain on one *side*.... But this raised the problem that one eye was

> always looking down into the sand and was effectively useless. In evolution this problem was solved by the lower eye 'moving' round to the upper side.

The development of flatfish is thus considered to recapitulate their evolutionary history.

The asymmetric geometry of flatfish has been likened to the cubist paintings of Pablo Picasso, and is often perceived as being "imperfect", "grotesque", "strange", etc. It is likely that the asymmetry contributes to their survival by helping to disguise them on the ocean floor.

See also

- Angling

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Polymixiiformes

Beardfishes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Polymixiiformes**
Family: **Polymixiidae**
Genera
Polymixia Lowe, 1838
Berycopsis (extinct)
Dalmatichthys (extinct)
Omosoma (extinct)
Omosomopsis (extinct)

The **beardfishes** are a small family (**Polymixiidae**) of deep-sea marine ray-finned fish named for their pair of long hyoid barbels.

They are found in tropical and subtropical waters of the Atlantic, Indian and western Pacific Ocean.

Classification

Ten species of the single extant genus ***Polymixia*** are known,[1] along with several fossil genera.

At present they are classified in their own order **Polymixiiformes**,[2] but as Nelson says, "few groups have been shifted back and forth as frequently as this one".[3] Previous groupings include Beryciformes.

- Beardfish, Polymixia lowei Günther, 1859.
  Pacific beardfish, Polymixia berndti Gilbert, 1905.
  Polymixia salagomeziensis Kotlyar, 1991.
  Polymixia fusca Kotthaus, 1970.
  Polymixia yuri Kotlyar, 1982.
  Polymixia longispina Deng, Xiong & Zhan, 1983.
  Stout beardfish, Polymixia nobilis Lowe, 1838.
  Polymixia busakhini Kotlyar, 1993.
  Polymixia sazonovi Kotlyar, 1992.
  Silver eye, Polymixia japonica Günther, 1877.

References

1. ^ "Polymixiidae". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
2. ^ "Polymixiiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
3. ^ *Joseph S. Nelson. Fishes of the World. John Wiley & Sons. ISBN 0-471-54713-1.*

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Polypteriformes

Bichirs
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Polypteriformes**
Family: **Polypteridae**
Genera
Erpetoichthys
Polypterus
See text for species.

The **bichirs** are a family, **Polypteridae**, of archaic-looking ray-finned fishes, the sole family in the order **Polypteriformes**. They have thick bonelike scales and a series of dorsal finlets instead of a single fin. The finlets are topped with sharp spines. Their jaw structure more closely resembles that of the tetrapods than that of the teleost fishes. Bichirs have a number of other primitive characteristics, such as fleshy pectoral fins and spiracles. All species occur in freshwater habitats in Africa, mainly swampy, shallow floodplains and estuaries. They have rudimentary lungs, which allow them to obtain oxygen from the air when in poorly oxygenated waters. [1]They are popular subjects of public and large hobby aquaria.

Species

There are eighteen extant species and subspecies in two genera:[2]

- Genus *Erpetoichthys*
    - Reedfish, Erpetoichthys calabaricus Smith, 1865.
- Genus *Polypterus*
    - Guinean bichir, Polypterus ansorgii Boulenger, 1910.
      Nile bichir, Polypterus bichir bichir Lacépède, 1803.
      Polypterus bichir katangae Poll, 1941.
      Bichir, Polypterus bichir lapradei Steindachner, 1869.
      Barred bichir, Polypterus delhezi Boulenger, 1899.
      Polypterus endlicheri congicus Boulenger, 1898.
      Saddled bichir, Polypterus endlicheri endlicheri Heckel, 1847.
      Polypterus mokelembembe Schliewen & Schafer, 2006.[3]
      Ornate bichir, Polypterus ornatipinnis Boulenger, 1902.
      Polypterus palmas buettikoferi Steindachner, 1891.
      Shortfin bichir, Polypterus palmas palmas Ayres, 1850.
      Polypterus palmas polli Gosse, 1988.
      West African bichir, Polypterus retropinnis Vaillant, 1899.
      Polypterus senegalus meridionalis Poll, 1941.
      Gray bichir, Polypterus senegalus senegalus Cuvier, 1829.
      Polypterus teugelsi Britz, 2004.
      Mottled bichir, Polypterus weeksii Boulenger, 1898.

Extinct species include:

- Polypterus faraou Otero et al., 2006 — late Miocene.[4] in my opinion the fish looks very funny >

References

1. ^ Berra, Tim M. (2001). Freshwater Fish Distribution. San Diego: Academic Press. ISBN 0120931567
2. ^ "Polypteridae". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
3. ^ *Schliewen & Schafer (2006). "Polypterus mokelembembe, a new species of bichir from the central Congo River basin (Actinopterygii: Cladistia: Polypteridae).". Zootaxa **1129**: 23.*
4. ^ *Otero, Likius, Vignaud & Brunet (2006). "A new polypterid fish: Polypterus faraou sp. nov. (Cladistia, Polypteridae) from the Late Miocene, Toros-Menalla, Chad". Zoological Journal of the Linnean Society **146** (2): 227. DOI:10.1111/j.1096-3642.2006.00201.x.*

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Saccopharyngiformes

Swallowers and gulpers
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Saccopharyngiformes**
Families
Cyematidae
Eurypharyngidae
Monognathidae
Saccopharyngidae

Saccopharyngiformes is an order of unusual ray-finned fish superficially similar to eels, but with many internal differences. Most of the fish in this order are deep-sea types known from only a handful of specimens.

Saccopharyngiforms lack several bones, such as the symplectic bone, the bones of the opercle, and ribs. They also have no scales, pelvic fins, or swim bladder. The jaws are quite large, and several types are notable for being able to consume fish larger than themselves. Their myomeres (muscle segments) are V-shaped instead of W-shaped like in all other fish, and their lateral line has no pores, instead it is modified to groups of elevated tubules.

Classification

There are four families in the order:

- Cyematidae (bobtail snipe eels)
- Eurypharyngidae (pelican eel)
- Monognathidae
- Saccopharyngidae (swallowers, gulpers or gulper eels)

Diet

The gulper eel eats fish, copepods, shrimp, and plankton. It uses its mouth like a net by opening its large mouth and swimming at its prey.

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Salmoniformes

Salmonidae

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Superorder: Protacanthopterygii
Order: **Salmoniformes**
Family: **Salmonidae**
Genera: *(see text)*

Salmonidae is a family of ray-finned fish, the only family of order **Salmoniformes**. It includes the well-known salmons and trouts; the Atlantic salmons and trouts of genus Salmo give the family and order their names.

Together with the closely-related Esociformes (the pikes and related fishes), the Salmoniformes comprise superorder Protacanthopterygii.

- Family: Salmonidae
    - Subfamily: Coregoninae
        - Coregonus - Whitefishes
          Prosopium - round whitefishes
          Stenodus - inconnus
    - Subfamily: Thymallinae
        - Thymallus - Graylings
    - Subfamily: Salmoninae
        - Brachymystax - lenoks
          Hucho
          Oncorhynchus - Pacific salmon and trout
          Parahucho
          Salmo - Atlantic salmon and trout
          Salvelinus - Char and trout (e.g. Brook trout, Lake trout)
          Salvethymus

References

- Behnke, Robert J. *Trout and Salmon of North America,* Illustrated by Joseph R. Tomelleri. 1st Chanticleer Press ed. New York: The Free Press, 2002. ISBN 0-7432-2220-2

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Scorpaeniformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Scorpaeniformes**
Suborders
Anoplopomatoidei
Cottoidei
Dactylopteroidei
Hexagrammoidei
Normanichthyiodei
Platycephaloidei
Scorpaenoidei
See text for families

Scorpaeniformes is an order of ray-finned fish, also called the **Scleroparei** or **Dactylopteriformes**, closely related to and sometimes included in the Perciformes.

They are known as "mail-cheeked" fishes due to their distinguishing characteristic, the suborbital stay: a backwards extension of the third infraorbital bone (part of the skull, below the eye socket) across the cheek to the preoperculum, to which it is connected in most species.

Classification

The division of Scorpaeniformes into families is not settled; accounts range from 26 families[1][2] to 35 families[3][4].

- Suborder Anoplopomatoidei
    - Anoplopomatidae (sablefish and skilfish)
- Suborder Cottoidei
    - Superfamily Cottoidea
        - Abyssocottidae (deep-water sculpins)
        - Agonidae (poachers)
        - Bathylutichthyidae
        - Comephoridae (Baikal oilfishes)
        - Cottidae (sculpins)
        - Cottocomephoridae (Baikal sculpins)
        - Ereuniidae
        - Hemitripteridae (sea ravens and sailfin sculpins)
        - Icelidae (scaled sculpins)[5]
        - Psychrolutidae (fatheads)
        - Rhamphocottidae (grunt sculpin)
    - Superfamily Cyclopteroidea
        - Cyclopteridae (lumpsuckers)
        - Liparidae (snailfishes)
- Suborder Dactylopteroidei
    - Dactylopteridae (flying gurnards)
- Suborder Hexagrammoidei
    - Hexagrammidae (greenlings)
- Suborder Normanichthyiodei
    - Normanichthyidae
- Suborder Platycephaloidei
    - Bembridae (deepwater flatheads)
    - Hoplichthyidae (ghost flatheads)
    - Parabembridae[6]
    - Platycephalidae (flatheads)
- Suborder Scorpaenoidei
    - Apistidae[7]
    - Aploactinidae (velvetfishes)
    - Caracanthidae (orbicular velvetfishes)
    - Congiopodidae (horsefishes and pigfishes)
    - Eschmeyeridae
    - Gnathanacanthidae (red velvetfish)
    - Neosebastidae[7]
    - Pataecidae (Australian prowfishes)
    - Peristediidae[8]

Plectrogenidae[7]
Scorpaenidae (scorpionfishes and rockfishes)
Sebastidae[7]
Setarchidae[7]
Synanceiidae (stonefishes)
Tetrarogidae (waspfishes)[7]
Triglidae (searobins)

Notes and references

1. ^ *Joseph S. Nelson. Fishes of the World. John Wiley & Sons. ISBN 0-471-54713-1.*
2. ^ Scorpaeniformes (TSN 166702). Integrated Taxonomic Information System. Accessed on 31 March 2006.
3. ^ *William N. Eschmeyer, Carl J. Ferraris, Mysi D. Hoang, Douglas J. Long (1998). Catalog of Fishes. California Academy of Sciences. ISBN 0-940228-47-5.*
4. ^ "Scorpaeniformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
5. ^ Icelidae is described as a separate family by some sources [1], containing only the genus *Icelus*. However, this genus which is considered to be a member of Cottidae by most other sources [2]
6. ^ Parabembridae is included in Bembridae in ITIS and Nelson, but split in FishBase and Eschmeyer.
7. ^ ***a b c d e f*** Apistidae, Neosebastidae, Plectrogenidae, Sebastidae, and Setarchidae are included in Scorpaenidae in ITIS and Nelson, but split in FishBase and Eschmeyer.
8. ^ Peristediidae is included in Triglidae in ITIS and Nelson, but split in FishBase and Eschmeyer.

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Stephanoberyciformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Stephanoberyciformes**
Families
Melamphaidae (ridgeheads)
Gibberichthyidae (gibberfishes)
Stephanoberycidae (pricklefishes)
Hispidoberycidae

The **Stephanoberyciformes** are an order of marine ray-finned fishes, consisting of about 45 species, the majority (37) of which belong to the ridgehead family (Melamphaidae). The Stephanoberyciformes are mostly uncommon deep-sea species with little if any importance to commercial fishery. They share many morphological similarities with the Beryciformes, their sister order.

Common characteristics include a generally rounded body, a toothless palate, rather thin skull bones, and a missing orbitosphenoid bone (except for Hispidoberyx).

J.S. Nelson classifies the whalefishes (Cetomimiformes) as a superfamily Cetomimoidea of this order.

References

- J. S. Nelson, *Fishes of the World*

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Stomiiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Stomiiformes**
Suborders
Gonostomatoidei
Phosichthyoidei
See text for families.

Stomiiformes is an order of deep-sea ray-finned fishes of very diverse morphology, including dragonfishes, lightfishes, marine hatchetfishes, viperfishes, and loosejaws. The order comprises four families, more than fifty genera and a total of about 320 species. As usual for benthic fishes, there is no common name for all the species comprised in this order.

The smallest species of this order is Cyclothone pygmaeae, native to the Mediterranean Sea (1.5 cm for adult specimens), while the largest one is Opostomias micripnis, widely found in the Atlantic, Indian and Pacific Ocean (50 cm for adults). Other species range from less than 2 cm to more than 50 cm in length.

Contents

- 1 Distribution and morphology
- 2 Luminescence
- 3 Daily migration
- 4 Reproduction
- 5 Classification
- 6 References

Distribution and morphology

Members of this order are mostly benthic fishes (living in deep oceanic waters), even if certain of them are also found in middle waters. Their distribution around the world's oceans is very wide, ranging from subtropical and temperate water bodies up to subartic or even antarctic ones.

These fish have a nightmarish and weird appearance. They all have teeth on the premaxilla and maxilla. Their maxillary ligaments, as well as some muscles and certain bones in the branchial cavity, are specialized in a distinctive way. Most have large mouths extending back past the eyes (Some also have chin barbels). Several fins might be absent, and colors are typically dark brown or black.

Luminescence

As is the usual case for abyssal sea creatures, all members of Stomiiformes but one have luminescent organs (photophores), whose structure is characteristic of the order. The gleam emitted can be more or less strong and its color can be light yellow, white, violet or red. The lighting mechanism can be very simple — consisting of small gleaming points on the fish body — or very elaborate, involving lenses and refractors.

The most common arrangement is one or two rows of photophores on the lower part of each side of the body. The rows run from the head down to the tip of the tail. Photophores are also present at the tip of chin barbels. Stomiiforms do not seem to utilize bacteria as their lighting source: no bacterium has ever been found in their photophores. However, recent researches have found that a piece of bacterium-like DNA in one photophore, which suggests that these contain bacteria that must have been largely modified.

The light coming from these fish is generally invisible to their prey.

Daily migration

During the day, Stomiiformes fish stay in deep waters and measure the intensity of the light that reaches them. By doing so, they manage to stay in the region that always has the same light intensity. When the sun sets, the fish follows the dimming sunlight up to near-surface waters. The upper regions are richer in animal life: small fishes, and planktonic invertebrates. The fish hunt and feed on these organisms all night long and swim back to deep waters as soon as the sun rises.

This daily migration is well observed at quite a few species of stomiiforms. However it is not specific to this fish order, and some larger species of the order — among them the largest predator of the oceans — stay in their deep-sea habitat and feed on smaller migrants that return from the surface.

Reproduction

Stomiiforms lay eggs generally in deep seas, but the eggs are light and float towards the ocean surface. They hatch in surface waters. When the larvae have completed their metamorphosis and look like adults, they descend to join the adults.

Like a lot of benthic fish species, certain members of the order — especially in the genera Gonostoma and Cyclothone — change their sex during their life. They are born being males, then transform into females.

Classification

There are four families in two suborders:

- Suborder Gonostomatoidei
    - Gonostomatidae — bristlemouths
      Sternoptychidae — marine hatchetfishes
- Suborder Phosichthyoidei
    - Phosichthyidae — lightfishes (spelled Photichthyidae in J. S. Nelson)
      Stomiidae — barbeled dragonfishes and loosejaws.

Primitive stomiiforms had thin brownish bodies, with rows of egg-shaped photophores adorning the lower body parts, and mouths with numerous teeth. From this primitive form two evolutive lineages diverged.

In the suborder Gonostomatoidei, the Gonostomatidae are primitive and the Sternoptychidae are more derived.

In the suborder Phosichthyoidei, the Phosichthyidae are also primitive bioluminescent organisms, while the Stomiidae are extremely derived and diverse.

References

- J. S. Nelson, Fishes of the World

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Synbranchiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Synbranchiformes**
Families
Synbranchidae
Chaudhuriidae
Mastacembelidae

Synbranchiformes, often called **swamp eels**, is an order of ray-finned fishes that are eel-like but have spiny rays, indicating that they belong to the superorder Acanthopterygii.

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Syngnathiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Syngnathiformes**
Families
Aulostomidae
Centriscidae
Fistulariidae
Solenostomidae
Syngnathidae

Syngnathiformes is an order of ray-finned fishes that includes the pipefishes and seahorses.[1]

These fishes have elongate, narrow, bodies surrounded by a series of bony rings, and small, tubular mouths. Several groups live among seaweed and swim with the body aligned vertically, to blend in with the stems.

The name "Syngnathiformes" is derived from Greek syn meaning "with", gnathos meaning "jaw" and Latin *forma* meaning "shape".

Classification

In Nelson[2] and ITIS[3] these fishes are placed as the suborder **Syngnathoidei** of the order Gasterosteiformes together with the sticklebacks and their relatives. In FishBase[4] these groups are treated as sister orders.

FishBase lists five families:

- Aulostomidae (cornetfishes and trumpetfishes)
  Centriscidae (razorfishes, shrimpfishes and snipefishes)[5]
  Fistulariidae (cornetfishes)
  Solenostomidae (false pipefishes, ghost pipefishes and tubemouth fishes)
  Syngnathidae (pipefishes and seahorses)

References

1. ^ "Syngnathiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
2. ^ *Joseph S. Nelson. Fishes of the World. John Wiley & Sons. ISBN 0-471-54713-1.*
3. ^ Actinopterygii (TSN 166361). Integrated Taxonomic Information System. Accessed on 3 April 2006.
4. ^ "Gasterosteiformes". *FishBase*. Ed. Ranier Froese and Daniel Pauly. February 2006 version. N.p.: FishBase, 2006.
5. ^ In ITIS, the snipefishes are split into their own family, Macroramphosidae.

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Tetraodontiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Tetraodontiformes**
Families: See text.

The **Tetraodontiformes** are an order of highly derived ray-finned fish, also called the **Plectognathi**. Sometimes these are classified as a suborder of the Perciformes. The Tetraodontiformes are represented by ten families and approximately 360 species overall; most are marine and dwell in and around tropical coral reefs, but a handful of species are found in freshwater streams and estuaries. They have no close relatives, and descend from a line of coral-dwelling species that emerged around 40 million years ago.

Physical characteristics

Various bizarre forms are included here, all radical departures from the streamlined body plan typical of most fishes. These forms range from nearly square or triangular (boxfishes), globose (pufferfishes) to laterally compressed (filefishes). They are ostraciiforms, meaning the body is inflexible, and undulation during movement is limited to the caudal fin. Because of this, they are slow-moving and rely on their pectoral and caudal fins for propulsion. However, movement is usually quite precise; dorsal and anal fins aid in manoeuvring and stabilizing. In most species, all fins are simple, small, and rounded.

The tetraodontiform strategy seems to be defense at the expense of speed, with all species fortified with scales modified into strong plates or spines — the latter sometimes retractable and able to lock in place (the triggerfishes) — or with tough, leathery skin (the filefishes and ocean sunfish). Another striking defensive attribute found in the pufferfishes and porcupinefishes is the ability to inflate the body to greatly increase its normal diameter: this is accomplished by sucking water into a diverticulum of the stomach. Many species of the Tetraodontidae, Triodontidae and Diodontidae are further protected from predation by tetraodotoxin, a powerful neurotoxin concentrated in the animals' internal organs.

Tetraodontiforms have highly modified skeletons, with no nasal, parietal, infraorbital, or (usually) lower rib bones. The bones of the jaw are modified and fused into a sort of "beak"; there are visible sutures which divide the beaks into "teeth". This is alluded to in their name, derived from the Greek words tetra meaning "four" and odous meaning "tooth" and the Latin *forma* meaning "shape". Counting these teeth-like bones is a way of distinguishing similar families. For example the Tetraodontidae ("four-toothed"), Triodontidae ("three-toothed"), and Diodontidae ("two-toothed").

The jaws are aided by powerful muscles and many species also have pharyngeal teeth to further process prey items. This is because Tetraodontiformes prey mostly on hard-shelled invertebrates such as crustaceans and shellfish.

The Molidae are conspicuous even within this oddball order: they lack swim bladders and spines, and are propelled by their very tall dorsal and anal fins. The caudal peduncle is absent and the caudal fin is reduced to a stiff rudder-like structure. Molids are pelagic rather than reef-associated and feed on soft-bodied invertebrates, especially jellyfish.

Families

The Honeycomb cowfish is part of the Ostraciidae family.

- Aracanidae
  Balistidae — triggerfishes
  Diodontidae — porcupinefishes
  Molidae — ocean sunfish and relatives
  Monacanthidae — filefishes
  Ostraciidae — boxfishes
  Tetraodontidae — pufferfishes
  Triacanthidae — triplespines
  Triacanthodidae — spikefishes
  Triodontidae — three-toothed puffer

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Zeiformes

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: **Zeiformes**
Families
Suborder Zeioidei
Cyttidae
Grammicolepididae
Oreosomatidae (oreos)
Parazenidaen (parazen and allies)
Zeidae (true dories)
Zenionidae (Macrurocyttidae)
Suborder Caproidei
Caproidae (boarfishes)

The **Zeiformes** are a small order of marine ray-finned fishes most notable for the dories, a group of common food fish. The order consists of about 40 species in seven families, mostly deep-sea types.

Zeiform bodies are usually thin and deep. Mouths are large, with distensible jaws, and there is no orbitosphenoid]. Pelvic fins have 5-10 soft rays and possibly a spine, 5-10 dorsal fin spines and up to 4 anal fin spines.

The classification of the boarfishes (Caproidae) in this order is uncertain, since they have many perciform characters, for instance in the caudal skeleton.

References

- J.S. Nelson, *Fishes of the World*

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Lobe-finned fish

Sarcopterygii
Fossil range: Latest Silurian - Recent
Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Infraphylum: Gnathostomata
Superclass: Osteichthyes
Class: **Sarcopterygii**

Subclasses
Coelacanthimorpha - Coelacanths
Dipnoi - Lungfishes
Tetrapodomorpha - Tetrapods

Sarcopterygii (from Greek *sarx*, flesh, and *pteryx*, fin) is traditionally the class of lobe-finned fishes, consisting of lungfish and coelacanths. These are bony fish with paired rounded fins. These fins, being similar to limbs, suggest that these fish may be ancestors of land vertebrates.

Most taxonomists who subscribe to the cladistic approach include within this group the superclass Tetrapoda, which in turns consists of all species of four-limbed vertebrates. The fin-limbs of sarcopterygiians show such a strong similarity to the expected ancestral form of tetrapod limbs that they have been universally considered the direct ancestors of tetrapods in the scientific literature.

Taxonomy and Phylogeny

- **Class SARCOPTERYGII**
    - **Subclass Coelacanthimorpha**
        - Order Coelacanthiformes
    - **Rhipidistia**
        - **Subclass Dipnoi**
            - Order Ceratodontiformes
              Order Lepidosireniformes
        - **Subclass Tetrapodomorpha**
            - Order Rhizodontida
            - Superorder Osteolepidida
                - Family Tristichopteridae
                    - Eusthenopteron
                      Hyneria
                - Order Osteolepiformes
            - Order Panderichthyida
            - *Tiktaalik*
            - **Tetrapoda**

- *Panderichthys*, suited to muddy shallows;
- *Tiktaalik* with limb-like fins that could take it onto land;
- Early tetrapods in weed-filled swamps, such as:
    - *Acanthostega* which had feet with eight digits,
    - *Ichthyostega* with limbs.

Descendants also included pelagic lobe-finned fish such as coelacanth species.

Evolution of Sarcopterygii

Sarcopterygians belong to Osteichthyes group or bony fishes, characterized by their bony skeleton instead of cartilage. The oldest Sarcopterygians were found in the Uppermost Silurian. The first Sarcopterygian closely resembled Acanthodians. The Sarcopterygians closest relatives were the Actinopterygians - ray-finned fishes. Sarcopterygians probably evolved in the oceans, but they later came into freshwater habitats to avoid the predatory placoderms - which were dominant in the Early - Middle Devonian seas. As Sarcopterygians evolve in the Early Devonian, the line splits into two main lineages - the Coelacanths, and the Rhipidistians. The Coelacanths appeared in the Early Devonian, and stayed in the oceans, the coelacanths heyday was the Late Devonian and Carboniferous because they were more common at these times than any other period in the Phanerozoic. Coelacanths still live today in the oceans. Rhipidistians appeared about the same time as the Coelacanths, but unlike them, Rhipidistians left the ocean world and migrated into the freshwater habitats, their ancestors probably lived in the oceans near the river mouths (estuaries). The Rhipidistians in turn split into two major groups - the lungfishes, and the tetrapodomorphs. The lungfishes' greatest diversity was in the Triassic Period, but today, there are less than a dozen genera left. The lungfishes evolved the first proto-lungs and proto-limbs. The lungfishes, ancient and modern, used their stubby fins (proto-limbs) to walk in land if their waterhole is depleted, and used their lungs to breathe air and get sufficient oxygen. The tetrapodomorphs have the same identical anatomy as the lungfishes, who were their closest kin, but the tetrapodomorphs appear to have stayed in water a little longer until the Late Devonian. Tetrapods - four legged vertebrates were the terapodomorphs descendants. Tetrapods appeared in the Late Devonian epoch.

See also

- Actinopterygii - ray-finned fishes

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Lungfish

Fossil range: Early Devonian - Recent

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Sarcopterygii
Subclass: **Dipnoi,** Müller, 1844
Orders: See text.

Lungfishes are sarcopterygian fish belonging to the order Dipnoi. Lungfish are best-known for retaining characteristics primitive within the Osteichthyes, including the ability to breathe air, and structures primitive within Sarcopterygii, including the presence of lobed fins with a well-developed internal skeleton. Today, they live only in Africa, South America, and Australia. While vicariance would suggest this represents an ancient distribution limited to the Mesozoic supercontinent Gondwana, the fossil record suggests that advanced lungfish had a cosmopolitan freshwater distribution and that the current distribution of modern lungfish species reflects extinction of many lineages following the breakup of both Pangea and subsequently Gondwana and Laurasia.

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- 1 Anatomy
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- 5 References

Anatomy

All lungfish demonstrate an uninterrupted cartilaginous notochord and an extensively developed palatal dentition. Basal lungfish groups may retain marginal teeth and an ossified braincase, but derived lungfish taxa, including all modern species, show a significant reduction in marginal bones and a cartilaginous braincase. The bones of the skull roof in primitive lungfish are covered in a mineralized tissue called cosmine, but in post-devonian lungfishes, the skull roof is subdermal and the cosmine covering is lost. All modern lungfish show significant reductions and fusions of the bones of the skull roof, and the specific bones of the skull roof show no homology to the skull roof bones of actinopterygiians or tetrapods.

The dentition of lungfish is conspicuously different from that of any other vertebrate group. Odontodes on the palate and lower jaws develop in a series of rows to form a fan-shaped occlusion surface. These odontodes then wear to form a uniform crushing surface. In several groups, including the modern lepidosireniformes, these ridges have been modified to form occluding blades.

The modern lungfishes have a number of larval features, which suggest paedomorphosis. They also demonstrate the largest genome among the vertebrates.

Modern lungfish all have an elongate body with fleshy paired pectoral and pelvic fins and a single unpaired caudal fin replacing the dorsal, caudal, and anal fin of most fishes.

Behavior

African and South American lungfish are capable of surviving seasonal desiccation of habitats by burrowing into mud and estivating throughout the dry season. Changes in physiology allow the lungfish to slow its metabolism to greater than 1/60th of the normal metabolic rate, and protein waste is converted from ammonia to less-toxic urea (normally, lungfish excrete nitrogenous waste as ammonia directly into the water). Burrowing is seen in at least one group of fossil lungfish, the Gnathorhizidae. It has been proposed both that burrowing is plesiomorphic for lungfish as well as that gnathorhizids are directly ancestral to modern Lepidosireniformes, but it is possible that the similarity is simply due to convergent evolution or parallel evolution.

Taxonomy

Taxonomy of lungfishes can be viewed in terms of taxonomic position of lungfishes within Osteichthyes and taxonomic relationships within lungfishes.

The former is well-resolved. In a cladogram of osteichthyan relationships, lungfishes clade closest with Powichthyes, and then with the Porolepiformes. Together, these taxa form the Dipnomorpha. The dipnomorpha form a sister group to the tetrapodomorpha. Together, these are known as the Rhipidistia, and form a sister group to the coelacanths.

The latter is significantly more difficult to resolve. While Devonian lungfish retain enough ossification of the endocranium to determine relationships, post-Devonian lungfish are represented entirely by skull roofs and teeth, as the rest of the skull is cartilaginous. Additionally, many of the taxa that have been identified may not be monophyletic. Current phylogenetic studies support the following relationships of major lungfish taxa:

```
Subclass DIPNOI ,--†Family Diabolichthyidae | ,--
†Family Uranolophidae | | __,--†Family
Speonesydrionidae '-|-| '--†Family Dipnorhynchidae |
,--†Family Stomiahykidae '---| ____ ,--†Family
Chirodipteridae | '-|--†Family Holodontidae |------
†Family Dipteridae | __,--†Family [[Fleurantiidae]
'-| '--†Family Rhynchodipteridae '--†Family
Phaneropleuridae | ,--†Family Ctenodontidae '-| ,--
†Family Sagenodontidae '-|--†Family Gnathorhizidae
'--Order Ceratodontiformes |--†Family
Asiatoceratodontidae |--†Family Ptychoceratodontidae
|--Family Ceratodontidae | '--†Genus Ceratodus | '--
†Genus Metaceratodus '--Family Neoceratodontidae |
'--†Genus Mioceratodus | '--Genus Neoceratodus -
Queensland Lungfish '--Order Lepidosireniformes '--
Family Lepidosirenidae - South American lungfish '--
Family Protopteridae - African Lungfish
```

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Schultze, HP, and Chorn, J., (1997). The Permo-Carboniferous genus Sagenodus and the beginning of modern lungfish. Contributions to Zoology 61(7):9-70.

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Prehistoric fish

Prehistoric fish are various groups of fishes that lived before recorded history. A few, such as the coelacanth still exist today and are considered living fossils.

The first fish and indeed the first vertebrates, were the ostracoderms, which appeared in the Cambrian Period, about 510 million years ago, and became extinct at the end of the Devonian, about 350 million years ago. Ostracoderms were jawless fishes found mainly in fresh water. They were covered with a bony armor or scales and were often less than 30 cm (1 ft) long. The ostracoderms are placed in the class Agnatha along with the living jawless fishes, the lampreys and hagfishes, which are believed to be descended from the ostracoderms.

The first fish with jaws, the acanthodians, or spiny sharks, appeared in the late Silurian, about 410 million years ago, and became extinct before the end of the Permian, about 250 million years ago. Acanthodians were generally small sharklike fishes varying from toothless filter-feeders to toothed predators. They were once often classified as an order of the class Placodermi, another group of primitive fishes, but recent authorities tend to place the acanthodians in a class by themselves (class Acanthodii) or even within the class of modern bony fishes, the Osteichthyes. It is commonly believed that the acanthodians and the modern bony fishes are related and that either the acanthodians gave rise to the modern bony fishes or that both groups share a common ancestor.

The placoderms, another group of jawed fishes, appeared at the beginning of the Devonian, about 395 million years ago, and became extinct at the end of the Devonian or the beginning of the Mississippian (Carboniferous), about 345 million years ago. Detailed anatomical studies of fossil remains by the Swedish scientist Erik Stensiö strongly suggest that the placoderms were closely related to sharks. Placoderms were typically small, flattened bottom-dwellers, however, many, particularly the arthrodires, were active midwater predators. Dunkleosteus was the largest and most famous of these. The upper jaw was firmly fused to the skull, but there was a hinge joint between the skull and the bony plating of the trunk region. This allowed the upper part of the head to be thrown back, and in arthrodires, this allowed them to take larger bites.

The cartilaginous-skeleton sharks and rays, class Chondrichthyes, which appeared about 370 million years ago in the middle Devonian, are generally believed to be descended from the bony-skeleton placoderms. The cartilaginous skeletons are considered to be a later development.

The modern bony fishes, class Osteichthyes, appeared in the late Silurian or early Devonian, about 395 million years ago. The early forms were freshwater fishes, for no fossil remains of modern bony fishes have been found in marine deposits older than Triassic time, about 230 million years ago. The Osteichthyes may have arisen from the acanthodians. A subclass of the Osteichthyes, the ray-finned fishes (subclass Actinopterygii), became and have remained the dominant group of fishes throughout the world. It was not the ray-finned fishes, however, that led to the evolution of the land vertebrates.

The ancestors of the land vertebrates are found among another group of bony fishes called the Choanichthyes or Sarcopterygii. Choanate fishes are characterized by internal nostrils, fleshy fins called lobe fins, and cosmoid scales. The choanate fishes appeared in the late Silurian or early Devonian, more than 390 million years ago, and possibly arose from the acanthodians. The choanate fishes include a group known as the Crossopterygii, which has one living representative, the coelacanth (Latimeria). During the Devonian Period some crossopterygian fishes of the order (or suborder) Rhipidistia crawled out of the water to become the first tetrapods.

The story of vertebrate evolution started in the seas of the Cambrian period, when jawless, toothless, soft-bodied fishlike creatures wriggled through the water, sucking up microscopic food particles. Only after tough, non-decaying bone was developed (initially as a scaly outer covering and later within the body) did fossils form and become preserved in the rocks. And only then could paleontologists take up the story with any certainty.

The earliest traces of bony scales are found in rocks of the Late Cambrian period, and the first recognizable vertebrate fish has been found in Australian rocks of Early Ordovician age. So, the first chapter in the vertebrate evolution starts with the ancient Arandaspis, a fish about 6in/15cm long with no jaws, no teeth and no fins other than a tail. It did, however, have gills and a stiffening rod of cartilaginous material (the notochord) that served as a backbone.

Late Devonian vertebrate speciation saw lobe-finned fish like Panderichthys having descendants such as Eusthenopteron which could breathe air in muddy shallows, then Tiktaalik whose limb-like fins could take it onto land, preceding the first tetrapods such as Acanthostega whose feet had eight digits, and Ichthyostega with developed limbs, negotiating weed-filled swamps. Lobe-finned fish evolved into Coelacanth species which survive to this day.

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- 1 Jawless fish
- 2 Cartilaginous fish
- 3 Sharks, acanthodians and placoderms
- 4 Primitive ray-finned fish
- 5 Modern ray-finned fish
- 6 Fleshy-lobed fish
- 7 References

Jawless fish

- Arandaspis
  Astraspis
  Boreaspis
  Dartmuthia
  Doryaspis
  Drepanaspis
  Errivaspis
  Haikouichthys
  Hemicyclaspis
  Jamoytius
  Myllokunmingia
  Pharyngolepis
  Promissum
  Pteraspis
  Thelodus
  Tremataspis

Cartilaginous fish

- Cladoselache
  Cobelodus
  Deltoptychius
  Heliobatis
  Hybodus
  Ischyodus
  Scapanorhynchus
  Sclerorhynchus
  Spathobathis
  Stethacanthus

- Tristychius
- Xenacanthus

Sharks, acanthodians and placoderms

- Acanthodes
- Bothriolepis
- Cladoselache
- Climatius
- Coccosteus
- Ctenurella
- Dunkleosteus
- Gemuendina
- Groenlandaspis
- Megalodon or Megatooth shark
- Mesacanthus
- Ostracoderm
- Palaeospondylus
- Pterichthyodes
- Squalicorax

Primitive ray-finned fish

- Aspidorhynchus
- Canobius
- Cheirolepis
- Dapedium
- Lepidotes
- Moythomasia
- Palaeoniscum
- Perleidus
- Platysomus
- Pycnodus
- Saurichthys
- Semionotus

Modern ray-finned fish

- Berycopsis
- Enchodus

Eobothus
Gryouchus
Gyrosteus
Hypsidoris
Hypsocormus
Knightia
Leptolepis
Pholidophorus
Protobrama
Sphenocephalus
Thrissops

Fleshy-lobed fish

- Chinlia
  Dipnorhynchus
  Dipterus
  Eusthenopteron
  Griphognathus
  Gyroptychius
  Holoptychius
  Macropoma
  Osteolepsis
  Strunius

References

- Janvier, Philippe. **Early Vertebrates** Oxford, New York: Oxford University Press, 1998. ISBN 0-19-854047-7

- Long, John A. **The Rise of Fishes: 500 Million Years of Evolution** Baltimore: The John Hopkins University Press, 1996. ISBN 0-8018-5438-5

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Acanthodii

Fossil range: Latest Ordovician to Early Permian

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Infraphylum: Gnathostomata
Class: **Acanthodii**
Orders
Climatiiformes
Ischnacanthiformes
Acanthodiformes

Acanthodii (sometimes called **spiny sharks**) is a class of extinct fishes, having features of both bony fish (Osteichthyes) and cartilaginous fish (Chondrichthyes). They appeared in the early Silurian (430 mya) and lasted until the late Permian (250 mya). The earliest ancanthodians were marine, but during the Devonian, freshwater species became predominant. They are distinguished in two respects: they were the first known jawed vertebrates, and they had stout spines supporting their fins, fixed in place and non-movable (like a shark's dorsal fin).

There were three orders: Climatiiformes, Ischnacanthiformes and Acanthodiformes. Climatiiforma had shoulder armor and many small sharp spines, Ischnacanthiforma with teeth fused to the jaw, and the Acanthodiforma were filter feeders, with no teeth in the jaw, but long gill rakers.

Almost all of them were small, slender fish with large eyes, heterocercal tails, with the caudal vertebrae supporting the top lobe of the tail fin, like a shark's tail has today. All had pairs of bony spines along the ventral mid-body line, that often supported a web of tissue between the spine and the body, creating a fin. Thus the "spiny shark" nickname. These distinctive spines give the class its name, from the Greek akanthos.

The scales of Acanthodii are unique and used in determining relative age of sedimentary rock. The scales are tiny, with a bulbous base, a neck, and a flat or slightly curved diamond-shaped crown.

References

Long, J.A. The Rise of Fishes: 500 Million Years of Evolution. Johns Hopkins Univ. Press. Baltimore and London. 1995.

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Placoderms

Conservation status: Fossil
Fossil range: Early/Mid Silurian - Late Devonian
Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Infraphylum: Gnathostomata
Class: **Placodermi,** McCoy, 1848
Orders
Antiarchi †
Arthrodira †
Petalichthyida †
Phyllolepida †
Ptyctodontida †
Rhenanida †
Acanthothoraci †
?Pseudopetalichthyida †
?Stensioellida †

The **Placodermi** are armoured prehistoric fishes known from fossils dating from the late Silurian to the end of the Devonian Period. Their head and thorax were covered by articulated armoured plates and the rest of the body was scaled or naked. Placoderms were among the first of the jawed fish, their jaws likely evolving from the first of their gill arches. There are studies that attribute to the Placodermi the first development of teeth. The first identifiable Placoderms evolved in the late Silurian; they disappeared in the Late Devonian extinctions. The first appearance of late Silurian placoderm fossils, in China, show the fishes already differentiated into Antiarchs and Arthrodires; apparently Placoderm diversity originated long before the Devonian, somewhere in the middle Silurian, though earlier fossils of basal Placodermi, have yet to be discovered in these particular strata.

The earliest studies of placoderms were published by Louis Agassiz, in his five volumes on fossil fishes, 1833 – 1843. The work of Dr. Erik Stensiö, at the Swedish Museum of Natural History, Stockholm, from the late 1920s established the details of placoderm anatomy, and identified them as true jawed fishes related to sharks.

References

- Janvier, Philippe. **Early Vertebrates** Oxford, New York: Oxford University Press, 1998. ISBN 0-19-854047-7
- Long, John A. **The Rise of Fishes: 500 Million Years of Evolution** Baltimore: The John Hopkins University Press, 1996. ISBN 0-8018-5438-5

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